

TROPICAL DISEASES BUREAU.

SANITATION SUPPLEMENTS

OF THE

TROPICAL DISEASES BULLETIN.

APPLIED HYGIENE IN THE TROPICS.

By LT.-COLONEL W. WESLEY CLEMESHA, C.I.E., I.M.S. (retd.).

SUPPLEMENT No. 3.]

1922.

[OCTOBER 31.

DISEASE PREVENTION.

ROCKEFELLER FOUNDATION. **The Rockefeller Foundation : A Review for 1921.** [VINCENT (George E.), President.]—59 pp. With 1 plate, 2 maps & 21 text figs. 1922. New York.

Each year we have these interesting résumés of the activities of the Rockefeller Foundation. The report for 1921 is just as important as any of the others and shows the extraordinarily wide nature of the work.

The map on the next page (fig. 83) shows in graphic form the work carried out during the year. It is unnecessary to describe it in detail.

As regards the actual combating of disease, the endeavours against yellow fever are engaging the attention of the staff. A photograph (fig. 84) of an interesting model of the various breeding places in a typical house in Mexico is reproduced. Concerning malaria, a large amount of propaganda and useful work has been done; see the accompanying poster (fig. 85), which was made use of in Louisiana.

In this number of the *Bulletin* are published many of the scientific results of work on the hookworm problem. The accompanying diagram (fig. 86) shows the very gratifying results obtained by this campaign in Virginia.

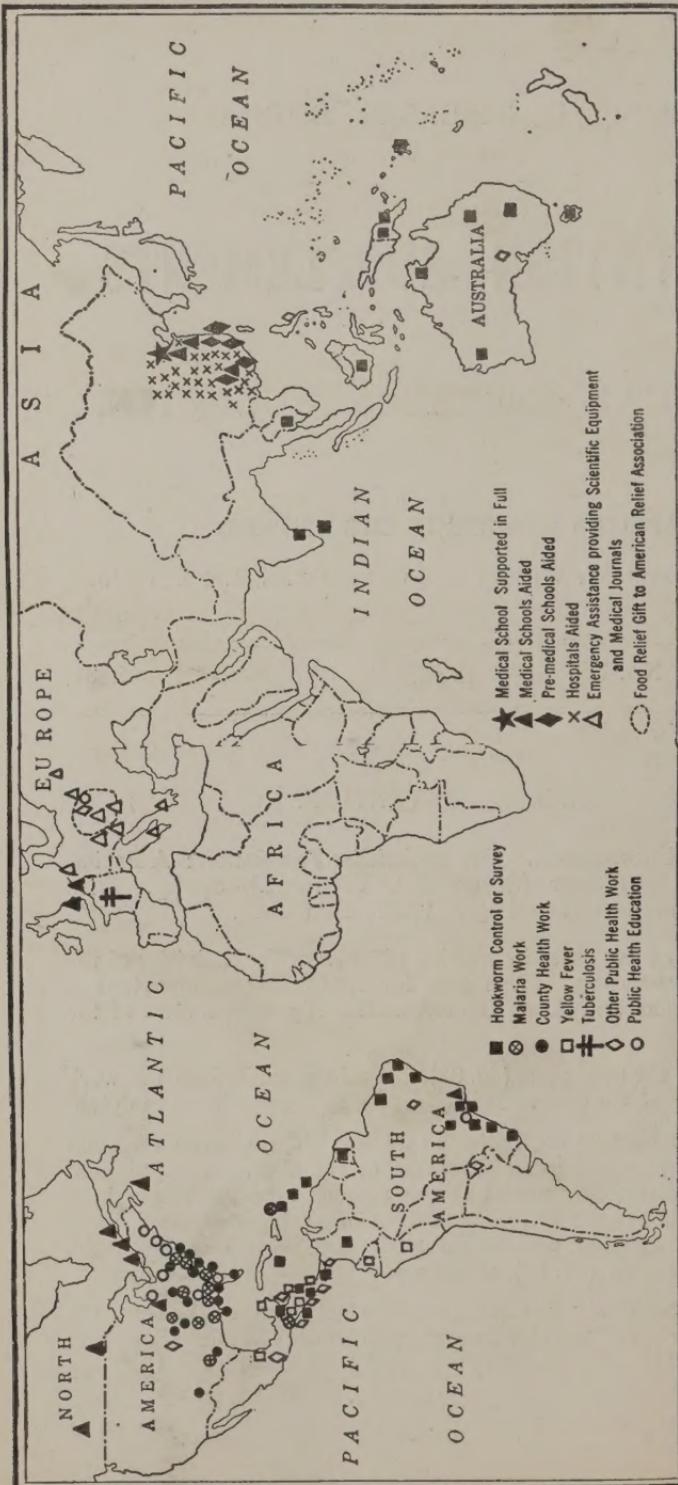


FIG. 83.—MAP OF WORLD-WIDE ACTIVITIES OF THE ROCKEFELLER FOUNDATION.

It is the purpose of the Rockefeller Foundation and its departmental boards to have a part in the world-wide movement for preventing disease and bringing about improved conditions of health. In 1921 aid was extended to five medical schools in Canada, to one in England, one in Belgium, one in Brazil, and one in the United States. In China a model medical school in Peking was supported in full, and three other medical schools, five pre-medical schools, and 29 hospitals aided. Two million dollars were given to Harvard for a School of Public Health; and the School of Hygiene and Public Health at Johns Hopkins University, and courses in hygiene at São Paulo, Brazil. A campaign against yellow fever was continued in Mexico and Central and South America. Aid was given to ten Southern States and two foreign countries to continue the work of malaria control. In 77 counties in 16 Southern States, county health organizations on a full-time basis was promoted in co-operation with State and local agencies. Hookworm work, now merged in county health programmes in the Southern States, was prosecuted abroad in 18 governmental areas. Anti-tuberculosis work in France was brought close to the point of complete relief to French agencies. The 1920 gift of \$1,000,000 for the relief of European children was completed. Emergency assistance in the form of scientific journals and apparatus for medical schools was continued in five countries and extended to four other countries in Europe.

(Reproduced from *The Rockefeller Foundation: A Review for 1921.*)

"The outlines of a world-wide campaign for health are beginning to emerge. Scientific research workers in many national centres are in constant communication. Knowledge is being applied more effectively to the problems in the field. Governments are sending attachés of hygiene into each other's territories. Vital statistics on an international scale are being reported more accurately. Prompt notification of epidemics is being facilitated. Outposts against plague and other diseases are being stationed and supported. Leaders and technical experts are in training in larger numbers and under more favourable conditions. Fundamental medical education is becoming more thorough and more cosmopolitan. Popular knowledge about preventive medicine and personal hygiene is increasing. Inter-communications of many kinds are being improved and multiplied. All these things are fostered by many methods and agencies, such as working agreements between governments, the Health Committee of the League of Nations, and the League of Red Cross Societies. It is the purpose of the Rockefeller Foundation and its Boards to have a part in this world-wide team-work for preventing disease and bringing about improved conditions of health, and thus 'to promote the well-being of mankind throughout the world.'"

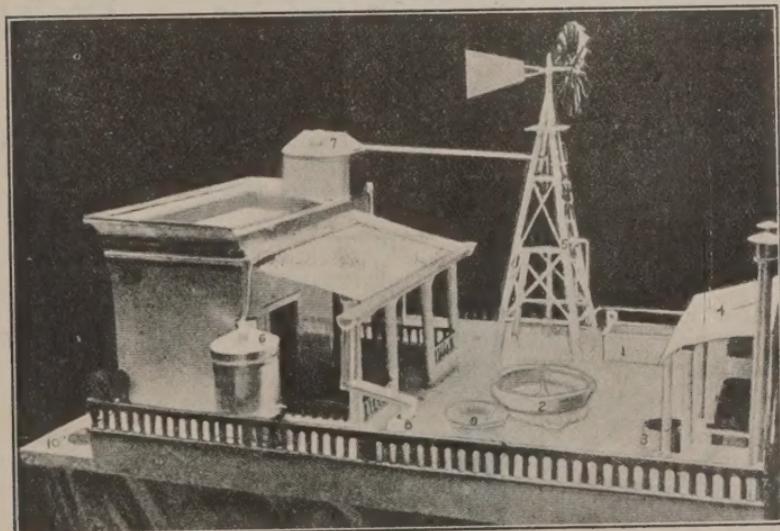


FIG. 84.—FAVOURITE BREEDING PLACES OF THE YELLOW FEVER MOSQUITO.

(Reproduced from *The Rockefeller Foundation: A Review for 1921*.)

This model of a typical home in Merida, Yucatan, showing various kinds of water containers in general use, was made after working hours, out of scrap tin, by an inspector of the Mexican department of health. (1) *Pileta* (holds water for animals); (2) fountain; (3) *lejia* (for softened water); (4) ventilator from cesspool; (5) tank on windmill frame; (6) tank in *patio* (receives rain-water from roof); (7) tank on roof (receives water from well); (8) *aljibe* (cistern); (9) *pozo* (well); (10) *pozo* (at street corner).

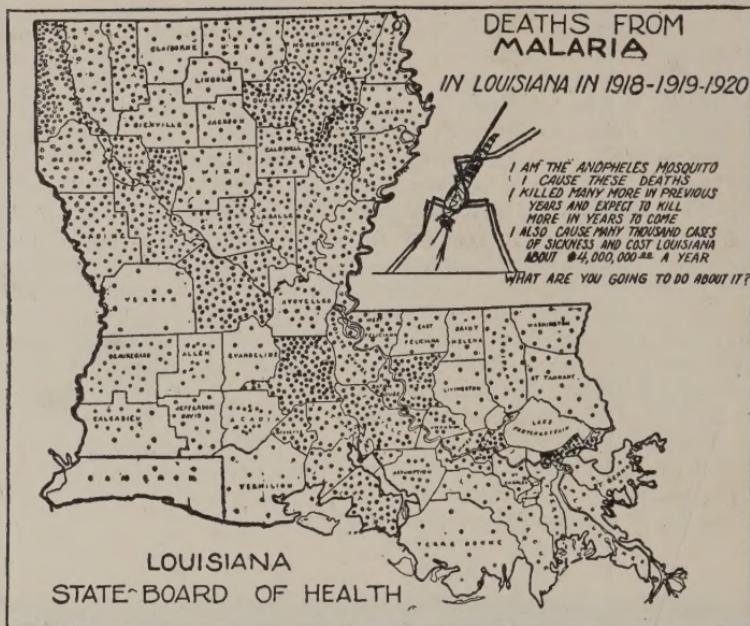


FIG. 85.—MAP USED IN ANTIMALARIA CAMPAIGN IN LOUISIANA.
 Each dot represents a death from malaria. The public health importance of malaria, however, is more accurately measured by the sickness rate and the loss of efficiency than by the loss of life. It has been estimated that for each death 2,000 to 4,000 days of sickness must be included in the total burden of loss and suffering caused by the malaria mosquito.

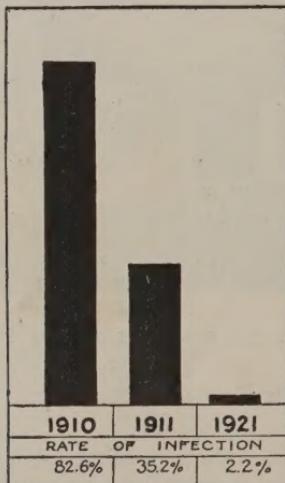


FIG. 86.—THE HOOKWORM STORY OF ONE COUNTY.

When the first demonstration in hookworm control in the United States was begun in a county of Virginia, in 1910, 82 per cent. of the school children were infected. As a result of intensive treatment the infection was reduced in 15 months to 35 per cent. Local agencies set in motion in 1910 have kept up the work until now hookworm infection in that county is negligible.

(Reproduced from *The Rockefeller Foundation: A Review for 1921.*)

BRAZIL. [Promotion of Public Health in Brazil. Extract from President's Message to Congress, May 4, 1922.] [MS. received from the Colonial Office.]

From recent information from Brazil it would appear that great activity prevails in the Health Department, particularly on the lines of amelioration of conditions amongst the rural population.

We have recently referred to work published by the Officers of the Rockefeller Foundation on hookworm in Brazil. Apparently a very extensive campaign is going on in that country, partly under the direction of these officers and partly under the local medical officers; malaria and yellow fever are also receiving a large amount of attention.

Government has recently ordered a concentration of energy on the subjects of venereal disease and leprosy. A fully equipped laboratory commenced working in June, 1921, and already a large amount of work has been done here as well as in the way of propaganda concerning venereal disease, cinematograph films, etc., being used to a considerable extent.

Notification of leprosy is now compulsory, and 726 cases have been notified since December 31, 1921.

Hospitals are being multiplied in the country and every endeavour is being made to increase the number of trained nurses. There appears to be a very great want of a trained staff in Brazil.

BALFOUR (Andrew). *The Outlook in Tropical Hygiene*.—*Jl. Roy. San. Inst.* 1922. July. Vol. 43. No. 1. pp. 1-14.

This is a very closely reasoned and scholarly paper, which it is practically impossible to review. It should be read by everybody from beginning to end.

The following short sentence in the early part of the paper may be said to be the theme on which the argument is based:—

“The future of Tropical Hygiene depends upon research.”

Research cannot go on without money, without sympathetic understanding from governments, without highly trained medical men, and without properly co-ordinated effort. This must be provided somehow if advance in the science of humanity is to be made.

We strongly recommend all our readers to obtain copies of this very delightful paper.

- i. PULIDO (A.). *L'hygiène des équipages à bord des navires de commerce*.—*Bull. Office Internat. d'Hyg. Publique*. 1922. June. Vol. 14. No. 6. pp. 686-687.
- ii. LUTRARIO (A.). *Les conditions hygiéniques des équipages de la marine marchande en Italie*.—*Ibid.* pp. 688-690.
- iii. JITTA (Josephus). *L'hygiène des équipages à bord des navires de commerce dans les Pays-Bas*.—*Ibid.* pp. 691-693.

i. The writer describes in a succinct manner the legislation dealing with the accommodation for ships' crews in Spain. He prefaches his remarks by saying that he considers an international set of regulations would be of great value. With certain reservations we are inclined

to agree, but it is often forgotten by medical men that the standard of hygiene laid down in the interests of the crew not infrequently takes up so much space as to render the ship non-productive. Provided the sanitarian and the directors of large shipping companies could meet and discuss the problem, we consider that it would be possible to arrive at some satisfactory rules for the housing of crews in ships. It must also be borne in mind that ships for work in the tropics require a very different standard of ventilation, etc., from those which habitually make use of the N. Atlantic.

The author deals with the position of closets, latrine accommodation necessary, the number of baths, and the size of bunks ; he recommends $2\frac{1}{4}$ sq. metres floor space per sailor. He also recommends hospital accommodation for 4 per cent. of the crew, with $3\frac{1}{2}$ sq. metres floor space, and a doctor and a dispenser for every ship that carries more than 40 crew. He further suggests that the minimum age for enlisting sailors should be 18 years, with a periodical examination up to the age of 20 years.

We consider that many of these recommendations are actually in excess of what is necessary. Hospital accommodation for 4 per cent. of the crew, with a separate cabin for infectious cases, is certainly beyond what is required for most vessels that are not many days between port and port.

ii. This article resembles in every way the last. In Italy the rations on board a merchant ship must not be inferior, either in quantity or quality, to those in the navy. The writer considers that 4,000 calories should be provided, instead of 3,057 and 2,631 for the navy and for emigrants. He thinks the poop of a ship superior to the forecastle for locating a crew.

Recent legislation has effected an improvement in ships' accommodation for crews in Italy.

iii. This paper gives the same details for the Netherlands. Each sailor is entitled to $3\frac{1}{2}$ cu. metres of space, $1\frac{1}{2}$ sq. metres of superficial floor space, with a height of $1\frac{3}{4}$ metres. Space occupied by furniture must be deducted from the total capacity of the forecastle. The size of the bunks should be 1.83 metres long by 0.56 metres in breadth, the forecastle to be warmed and suitably lighted ; petroleum lamps are forbidden.

Latrine accommodation at 1 seat for 10 persons, 2 for 10-25, 3 for 25-40, and so on. Dr. BOSMAR has recently treated the subject of the proper value of the vitamin element in ships' diets in the prevention of beriberi and scurvy.

HUNTINGTON (H. I.). Health Work in a Model Village. Second Annual Report of the Department of Health, Perry Point, Md.—Public Health Rep. 1922. May 5. Vol. 37. No. 18. pp. 1069-1086.

The writer describes the health conditions of a small settlement known as Perry Point. This was originally an ammonium nitrate plant and covered rather more than 516 acres. Eventually it was converted into a large hospital of 430 beds (a second one is about to be added), a village consisting of 200 houses, and a large medical store depot.

The settlement as a whole was run as a sort of standing example of how the health services of a town should be organized. The objects are summarized below.

"1. To carry out United States Public Service principles and plans, i.e.:—

"(a) To do on its own reservation what it advises other municipalities to do;

"(b) To assist in standardizing, as far as possible, public health problems which are common to all communities of a similar size;

"(c) To carry on public health work on the same economical basis as would be required of a health department where appropriation would naturally be limited.

"2. To supervise public health problems which would not be cared for by the state or county, since this is a government reservation.

"3. To protect the health of hospital patients, vocational trainees, and other federal beneficiaries.

"4. To prevent communicable diseases from being introduced by the large number of employees working on the reservation but living in the nearby towns."

The results of the figures obtained during the years 1919, 1920 and 1921 on the total population of 1,382 are given in great detail.

Year.	Population.	Birth-rate.	Death-rate.	Infant Mortality-rate.	Still Births.
1921 . . .	807	38·41	2·47	32·26	0
1920 . . .	839	39·33	3·57	30·30	4

Great care was taken with the health of school children, all possible defects were corrected, and weights were periodically recorded.

The household rubbish was disposed of by feeding pigs, with a profit of 902 dollars per annum.

General summary of results:—

"2. A comparatively small number of communicable diseases occurred on the reservation during the year.

"3. Over 90 per cent. of the school children are either naturally immune from diphtheria, as determined by the Schick test, or have been actively immunized.

"4. The medical examination of babies and school children resulted in the correction of many physical defects at an early age.

"5. The Junior Health Department organized in the school is playing an important rôle in the "health game."

"6. The safe water and milk supplies played an important part in maintaining a health standard.

"7. Under sanitary engineering work, mosquito control operations are outstanding. The almost complete absence of the mosquito as a pest, as well as a carrier of malaria, helps to make this reservation a desirable dwelling-place and a suitable place for United States veterans' hospitals. . . ."

O'CONNOR (Francis W.). **Some Results of Medical Researches in the Western Pacific.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1922. Mar. 16 & May 18. Vol. 16. Nos. 1 & 2. pp. 28-52. With 21 illustrations. [Discussion pp. 52-56.]

This paper is largely concerned with filariasis. The life-history of the worm, symptoms, etc., will be dealt with elsewhere in the *Bulletin*.

The disease is spread throughout the whole of Micronesia by *Stegomyia pseudoscutellaris*, which breeds in very small collections of fresh water in which decaying vegetable matter is present, the breeding-places themselves being protected from bright light and from the trade winds.



FIG. 87.—Uncleared bush—Native Plantation. *S. pseudoscutellaris* numerous owing to shelter.

[Reproduced by permission from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*.]



FIG. 88.—Cleared Plantation in Fiji with no shelter. *S. pseudoscutellaris* absent. (Photo by Dr. P. H. MANSON-BAHR.)



FIG. 89.—Coco-nut Husk and Shell Stacks. Exterior. No breeding-places visible.
[Reproduced by permission from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*.]

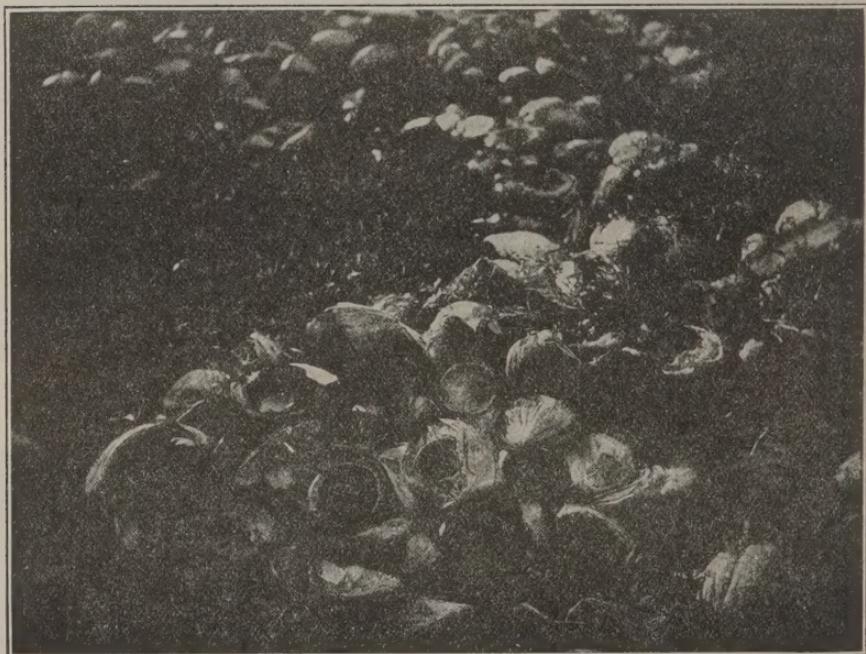


FIG. 90—Interior of same showing Nut-shells which contain Larvae and Pupae.
[Reproduced by permission from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*.]



FIG. 91.—Hole in lava rock, containing decaying leaves and water in which *S. pseudoscutellaris* breeds.

[Reproduced by permission from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*.]

Wherever these conditions as regards sun, light winds and decaying matter in the water are absent, there the mosquitoes are only found in very small numbers or not at all.

The commonest breeding-places in the island are the heaps of empty coco-nut shells. Only those at the bottom of the heap, however, are used by the mosquitoes, the top ones being too exposed to the wind and sunlight. Holes in coco-nut trees and cocoa-pods, the interior of which have been eaten out by the Pacific rat, also form a suitable place.

Very excellent pictures of the breeding-places themselves, and of the remedial measures, were shown. Dr. O'Connor considers that, situated as it is in small atolls, filariasis should be almost preventable if careful search is made for the breeding-places, and these be done away with.

CURJEL (Dagmar F.). **Note on the Weight Curve of the Normal Indian Infant, during the First Year.**—*Indian Med. Gaz.* 1922. Apr. Vol. 57. No. 4. pp. 128–130. With 2 charts.

The writer gives a graph (Fig. 92) of the growth in weight of 842 babies resident in Delhi and neighbourhood during the year 1921. She points out that the simplest way of obtaining these figures is to present every mother with a weight card on which to mark weekly weighments. It would also be an advantage to have the normal figures printed on the card, so as to see how nearly the particular infant approximates the normal or otherwise. Children that differ from normal are generally sick and require thorough examination as to the cause of the deviation.

TOLENTINO (Mariano). **Weight of Newborn Filipino Babies.**—*Jl. Philippine Islands Med. Assoc.* 1921. May–June. Vol. 1. No. 3. pp. 111–112.

"Among the difficulties that are met with in a consideration of this subject are the variations in the weights of newborn babies, which depend mainly upon a diversity of factors: namely, (1) the size of the parents, which seems to influence the size of the infant; (2) the age of the mother, as the largest children are born during the ages at which the woman is in the prime of motherhood; (3) the race of the parents, as the children of coloured races are not so heavy as those of the white; (4) the parity of the mother, because the children of primiparae are less in size and in weight than those of multiparae, and also because, as a rule, each foetus seems to weigh a little more than the preceding one; (5) the mode of life of the mother and her social position, which exert a marked influence upon the size and weight of the offspring; (6) the sex of the child, boys being heavier than girls; (7) the health of the parents, the children of parents of weak constitution being underweight; and (8) the person or persons who weigh the babies, and the scales upon which they are weighed, as it is no less important and necessary that the same persons perform the work and that the same scales be used."

Conclusions:—“1. The average weight of the Filipino child at birth may be stated as 2,924·2 gm. (6 lb. 12 oz.).

“2. The average weight of newborn babies in the charity ward is 2,962·4 gm. (6 lb. 15 oz.).

“3. The average weight of newborn babies in the pay department is 3,510·6 gm. (8 lb. 5 oz.).

“4. The babies of women who had stayed in the hospital for not less than ten days before childbirth were heavier than those born of mothers who did not enter the hospital until shortly before or during labour.”

BRITISH GUIANA. **The Baby Saving League of British Guiana. Eighth Annual Report, 1921.**—34 pp. Office: Government Public Health Department.

This small pamphlet gives a brief account of the activities of the league. A good deal of space is taken up with the finances and accounts of the organization. Apparently Government gives a subsidy of £1,000.

The activities take the form of training midwives and nurses, baby shows and running crèches on several of the sugar estates. A good deal is also done in the way of propaganda and educative measures.

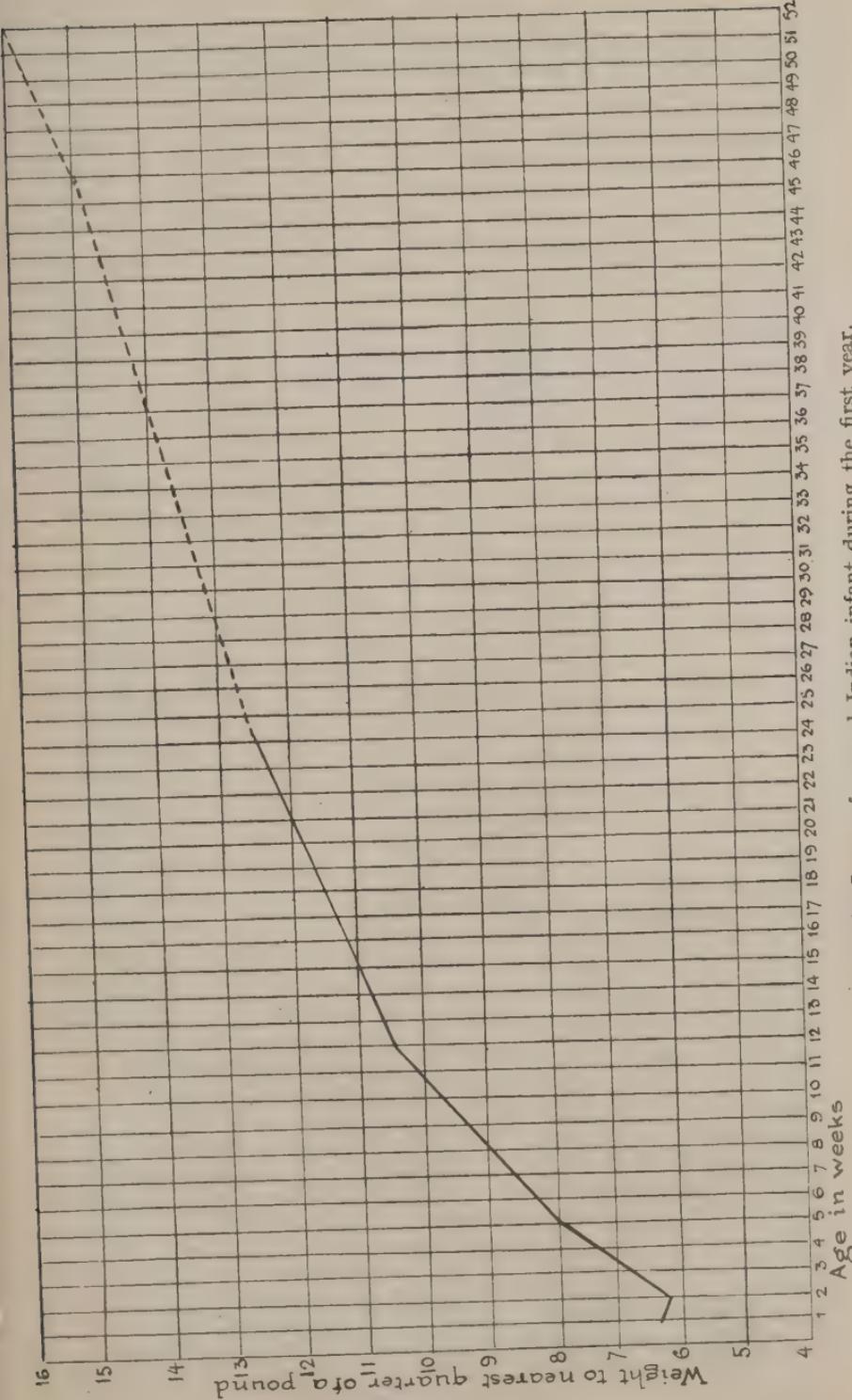


FIG. 92.—Weight Curve of normal Indian infant during the first year.

[Reproduced from the *Indian Medical Gazette*.]

TRANSVAAL EDUCATION DEPARTMENT. Report on the Medical Inspection of Schools for the Year ended 31st December, 1920. [LEIPOLDT (C. Louis), CLEAVER (Anne F.), ELIAS (P.), Medical Inspectors of Schools.] 60 pp. With 1 map, 2 plans & 10 illustrations. 1921. Pretoria: The Government Printing and Stationery Office.

This report is of particular interest to all concerned with school hygiene in tropical countries. We have never seen any report, previous to this, dealing with malaria from the point of view of Inspector of Schools. All who are interested should obtain a copy (from the Government Printing and Stationery Office, Pretoria).

The writer divides schools into three classes, according to the amount of malaria. First, those situated on the high veldt, which are practically free from malaria; secondly, the area of limited endemic prevalence; thirdly, the area of absolute endemic prevalence. We need not say anything about the first. The second include local centres, which contain a relatively large percentage of carriers or chronic malaria cases and prevalence of Anopheline mosquitoes. Schools in these areas are usually situated in the centre of a farming community, with residences near rivers and fountains, and invariably surrounded by dense shrub or grass and large numbers of native kraals. The disease is not very serious and, in fact, it may be actually dying out.

Concerning the third class, the percentage of carriers in the population is always extraordinarily large; the preponderance of natives resident in the area is an important factor. The disease is usually endemic, and even epidemics occur.

The months of March, April and May are those of largest incidence. The two varieties of Anopheline carriers are *Myzorhyncus mauritianus* and *maculipalpis*; there may, however, be others. These mosquitoes appear to attack cattle in preference to human beings. The disease causes much suffering, wastage in the teaching staff necessitating sick leave, and a considerable amount of loss due to fatigue and inability to do a sound day's work.

In the schools in the infected area as soon as the rains appear the attendance begins to fall off; three to five attacks, each lasting up to a fortnight, are not uncommon.

Then follows a very graphic and interesting description of the chronic malarious child. It is noted that the physical strength is diminished by two-fifths as registered by Collins' Dynamometer; the heart is also affected. The Ward Crompton test of vaso-motor efficiency was found to be considerably below the normal. The blood examination showed the typical signs of anaemia and parasites. The great similarity between the chronic syphilitic and the chronic malarial child is brought out.

Turning to the mentality test, the child is often so defective on account of low condition of health as not to pass the ordinary standard tests and to be classified as mentally defective. Some cases of this kind have been removed to the veldt and in six months have proved to be in reality perfectly normal; they are so anaemic that they cannot concentrate on their work and are consequently backward. It is, however, noteworthy that the general mentality of the second generation of the malarious family is usually very low, feeble-mindedness being common where malaria is prevalent.

The author sums up by saying that the characteristics of the chronic malaria child from a health point of view are fatigue, mal-nutrition and anaemia, all of which defects, it will be observed, are remedial.

" We are breeding in the malaria districts a generation of at least physical degenerates burdened by the weight of pre-natal mal-nutrition, and there is no evidence to show that we are even getting a vestige of racial immunity for it."

As regards the remedial measures these follow the usual lines. One gathers that mosquito curtains or wire gauze are not commonly made use of. The authors strongly recommend a thorough grounding of the child in the method of spread of malaria.

As regards the school curriculum longer intervals and shorter hours of work are recommended; some manual labour, such as carpentry, for the boys, and needlework and simple cooking for the girls, are advocated; longer vacations and a more suitable choice of months are also suggested.

The author gives some interesting figures about the amount of malaria in the various schools in the Transvaal, and finishes this very interesting article with the following recommendations :—

1. That steps be taken to make every teacher's residence in malarious areas mosquito-proof by the provision of suitable gauze netting, and that teachers in such areas be allowed to requisition for a supply of petroleum and a proper spray for the extermination of mosquito larvae in stagnant pools in the vicinity of such residences.

2. That quinine prophylaxis be carried out in all schools receiving climatic allowance and that adequate supplies of tonic medicine be made available at such schools for the use of necessitous children.

3. That educative propaganda be carried out in all malaria schools and that such propaganda be included in the curriculum on the lines already sketched.

4. That the question of centralizing malaria schools as much as possible and of providing mosquito-proof hostels at central situations in malarial areas, be taken into serious consideration.

5. That the question of changing the vacation periods along the lines indicated be considered at an early date.

6. That steps be taken to establish a convalescent seaside home of recovery on the Natal south coast for necessitous or paying malarious children along the lines already indicated.

7. That climatic allowance be subject to annual or biennial revision and that the Department should grant a bonus to teachers who have made their environment free from malaria or whose efforts have conduced to improve the conditions as regards malaria in their area.

8. That one of the school nurses be deputed to act as special nurse for all malaria schools and to devote her attention specially to the particular needs of such schools in areas where no school nurse is resident.

HAMID (Abdul). **Notes from the Diary of a Medical Inspector of Schools.** —*Indian Med. Gaz.* 1922. May. Vol. 57. No. 5.
pp. 169–172.

The author gives a rather rambling account of some of his experiences of examination of school children in Sind. He points out that defective eye-sight is not the most serious trouble in schools and usually develops as the boy gets older. In younger children enlarged tonsils are extremely common and frequently accompanied by adenoids and mouth breathing. Caries and pyorrhea are also common, particularly amongst children who chew betel. In Upper Sind, where betel is used less extensively, pyorrhea is much less common.

As regards the care of the teeth the writer does not think much of the ordinary "neem" twig as a toothbrush, for it does not clean the space between the teeth satisfactorily. Scabies is extraordinarily common in some schools.

- i. LUTRARIO (A.). **La lutte contre la malaria en Italie.**—*Bull. Office Internat. d'Hyg. Publique.* 1922. May. Vol. 14. No. 5. pp. 502-525. With 1 chart in text.
- ii. —. **Une école d'application de la lutte contre la malaria.**—*Ibid.* pp. 526-528.
- iii. PULIDO (Angel). **Le plan de lutte antipaludique en Espagne.**—*Ibid.* pp. 529-530.
- iv. COLOMBANI. **La lutte antipaludique au Maroc.**—*Ibid.* pp. 531-534.

i. The author gives an admirable résumé of the antimalarial work which has been done in Italy during the last 25 years. We need not describe this, because it is thoroughly well known to all interested in the subject. The graph given opposite (Fig. 93) shows the result.

Recently, on account of the war, there was a decided recrudescence of the disease owing to many factors, one being the fluctuation in the price of quinine and the difficulty of obtaining sufficient for prophylactic doses.

The following may also have had some indirect influence on spreading the disease:—An epidemic of smallpox, which was particularly serious in Southern Italy, and the pandemic of influenza in 1918-19.

On the cessation of hostilities every effort was made to restart the operations of the Health Departments. Italy has always concentrated on the extensive use of quinine; recently 25 per cent. of cinchonine has been included in the treatment, principally on the grounds of economy. The usual measures, such as drainage and antilarval measures of all kinds, have been started again. Several scientific commissions have been appointed to study the various aspects of the disease, these being (1) the "petite assainissement" (minor improvement works); (2) the best means of treating malaria; and (3) "radio therapy."

As a result of these combined efforts it will be seen that the curve of malaria deaths has returned almost to its pre-war level.

ii. The writer announces the fact that a school of antimalarial measures was started about three years ago, situated just on the edge of the famous Pontine Marshes, not far from Rome. The school is under the Director-General of Public Health and is intended to act as a centre for instructing medical officers in what may be called the "Science of Malariaology."

It is singularly well fitted to do this, because within a few miles of the laboratory can be seen some of the most prolific mosquito breeding-places in Italy, and practically every measure of reclamation of this area is available for teaching purposes, such as deep and superficial drainage, realignment of streams, simple antilarval measures against temporary collections of water, the use of quinine, etc.

The course is an intensive one and lasts for about two weeks. It is expected that the school will be instrumental in spreading knowledge of the best methods of remedying malaria amongst the medical practitioners, both of Italy and other countries.

iii. The author describes the lines on which antimalarial measures have been attempted in Spain; they follow the usual lines.

1. Major engineering works with drainage, realignment of streams, canalization of banks, etc.

2. Legal enactments permitting the free distribution of quinine to labourers in malarious regions.

3. Revision of the enactments dealing with the growing of rice to prevent stagnation of water longer than eight days on the rice fields.

4. The starting of propaganda and malarial education centres.

iv. The writer discusses the antimalarial measures in Morocco and divides the paper into two parts: (1) first, the rôle of the State under which the duties are thus sub-divided:—

(a) The judicious choice and control of new centres of colonization.

(*Proportions per 1,000,000 inhabitants*)

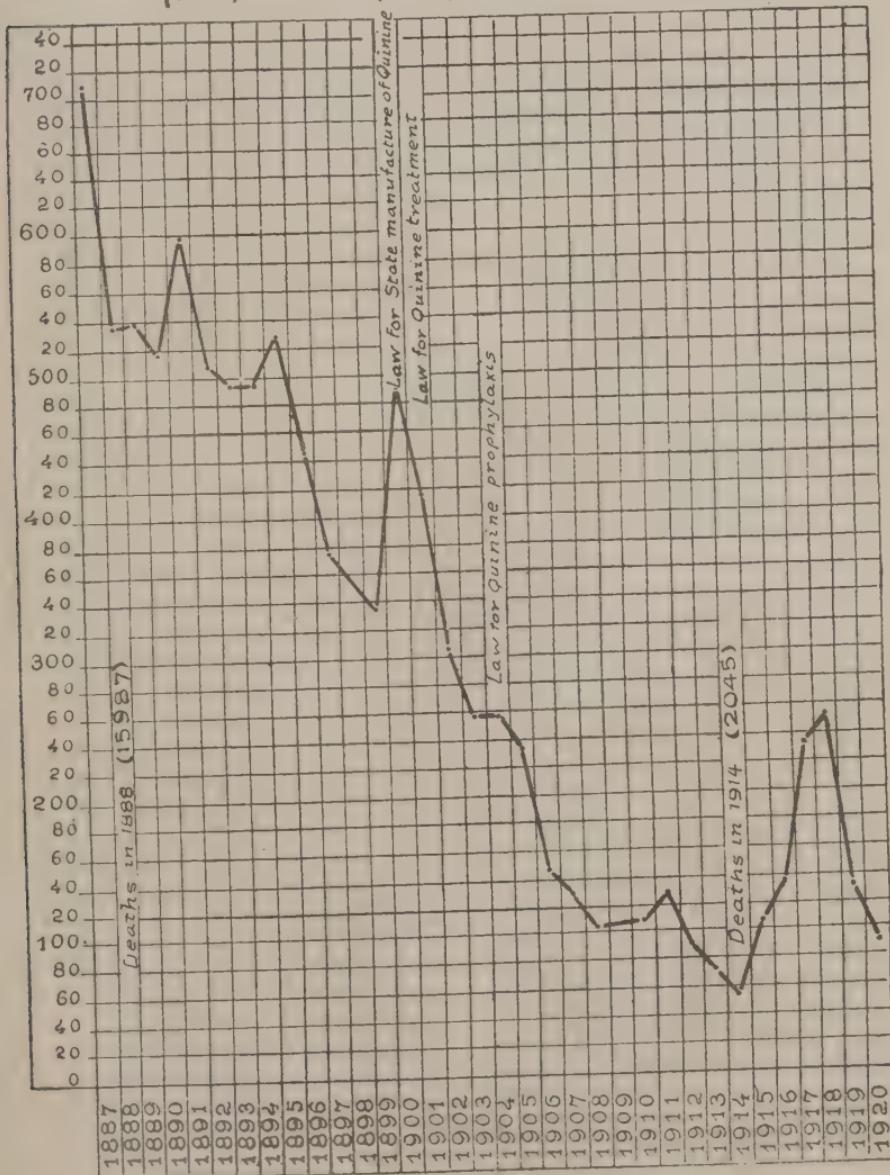


FIG. 93.—Mortality from malaria and malarial cachexia in Italy from 1887–1920.
(The figures for 1918–1920 are provisionally calculated and not official.)

[Reproduced from the *Bulletin de l'Office International d'Hygiène Publique*.]

(b) The apportioning of the country for the carrying out of the major antimalarial works, such as extensive drainage and control of water supply; these are beyond the means, both pecuniary and technical, of the ordinary colonist and must be carried out by the state.

(c) Regulations designed to enforce proper antimalarial measures on employers of labour.

(d) Antimalarial legislation somewhat on the lines of the Italian campaign, regulating such matters as the protection of workers against mosquitoes, distribution of quinine, etc.

(e) The supply of government quinine much on the lines that have been found suitable for Indo-China, Madagascar and Tunis.

(2) The rôle of the doctor.—This largely consists of a service of public hygiene, the establishment of local medical officers with adequate hospital accommodation and a special group of travelling sanitarians whose duty it is to carry out the actual antimalarial measures.

In conjunction with the above the public works and the irrigation department also assist in the campaign, particularly in the larger schemes.

These measures, together with the presence of enterprising colonists, have effected very great improvement in many districts. The motto of the enterprise has always been "Help yourself and the State will help you."

PALESTINE. Proceedings of the Antimalarial Advisory Commission.

Minutes of 1st, 2nd, 3rd and 4th Meetings (Oct., 1920; Jan., May, Dec., 1921). [HERON (G. W.), President.] [MS. received from the Colonial Office.]

These proceedings are interesting when read in connexion with the various reports on malaria in Palestine that have recently been written. The Committee appear to have a great deal of work in front of them.

"Mr. Briercliffe said that with regard to the minor measures directed against mosquito breeding at the end of October, 1921, there were 4,172 wells, 10,605 cisterns, 9,737 cesspits and 23,225 other possible mosquito breeding-places registered in the towns, and 14,848 such places in the villages of Palestine; a total of 68,587 places which required periodic inspection by the Antimalarial Sub-Inspectors.

"During the first 10 months of the present year 636,973 inspections of these places were made in towns, and 10,994 village visits were carried out. 29,956 places were made permanently mosquito-proof by repair, provision of covers, or other means.; 764 pumps were fitted to wells and cisterns. Anopheline larvae were found 3,675 times, and culicine larvae 5,814 times in towns; and in villages, mosquito larvae were found 14,653 times; 535,548 oilings were carried out, entailing an expenditure of 66,401 kilos of the paraffin-crude-oil mixture. There were 627 prosecutions instituted under the Public Notices regarding the Protection of Water Supplies, and under Sect. VII of Public Health Ordinance No. 1.

"All over the country there had been a very definite decrease in the amount of malaria this year. This had been particularly noticeable in the malarious country districts and also, but to a less extent, in towns. In Jerusalem, for example, deaths registered as due to malaria had been as follows:—

April 1, 1918, to March 31, 1919	..	124	deaths.
" 1919	..	28	"
" 1920	..	31	"
" 1921, to November 30, 1921	..	12	"
(8 months)			

NEVEUX. *Conditions de la prophylaxie de la malaria.*—*Rev. Méd. et Hyg. Trop.* 1922. Jan.-Feb. Vol. 14. No. 1. pp. 14-19.

The author's main contention in this brief paper is that all anti-malarial measures must for success pre-suppose an adequate supply of quinine. The mechanism for its distribution and sale should be in the hands of some central authority such as the Government. He contends that the amount of quinine in the world is not really sufficient to treat the large masses of primitive races in tropical countries; therefore it is the duty of governments to extend its cultivation as much as possible.

Recent figures show that in 1920 the export of cinchona bark reached 4,526 tons, or 418,861 kilos of quinine, a drop in quinine of rather more than 200,000 kilos compared with the previous year. This drop, as explained by the Board of Trade Journal is not due to less production, but to the fact that the Quinine Manufacturers' Association were holding up the stocks to prevent a fall in price. The writer criticizes this state of affairs.

UNITED STATES PUBLIC HEALTH SERVICE. **Man-made Malaria.**
(Health News. Mimeographed Circular K.298.)

"The task of eradicating malaria," says the U.S. Public Health Service, "has been made doubly hard by the continual creation of fresh mosquito-breeding spots by impounding water either intentionally or unintentionally—for instance, in the course of highway or railway construction. Owing to this a considerable portion of the malaria in the country may be termed 'man-made.' Asst. Surgeon General Carter, for instance, found that probably three-fourths of the malaria in a district in eastern Virginia came from such artificial pools and swamps.

"Man-made malaria is of special importance at present because of the recently enacted Federal highways act, which provides many million dollars for building additional good roads in the South. The specifications require that the culverts on these roads shall be so placed that they will completely drain all wet areas above the culvert entrance and that all borrow pits or excavations made along the roadways shall be filled or properly drained. Many Southern States have enacted laws of similar purpose.

"It is of the utmost importance to the public health that these State laws and Federal regulations shall be faithfully observed while the roads are being built, for at that time adequate drainage can be had with very little if any additional cost; whereas if through carelessness or wilfulness the culverts are placed too high or the borrow pits are not properly drained the expense for later rectification may be very great.

"The State highway engineer of Alabama recently strongly appealed to all State and county engineers and road officials to co-operate in carrying out these laws and regulations. Every community in the South should take particular interest in this subject and all good citizens should promptly report the whereabouts of any such disease-breeding spots that are being created in their vicinity and should insist on their eradication. Not to do so will inevitably mean more mosquitoes and more malaria about their homes.

"No road, however necessary for travel, can be called good if it interferes with proper drainage."

Practically every sanitary officer in the tropics could give instances of neglect of these elementary precautionary measures.

JOHNSON (E. B.). **Efficient and Economical Use of Oil in the Prevention of Malaria.**—*Southern Med. Jl.* 1922. May. Vol. 15. No. 5. pp. 374-376.

The author discusses the use of oil in antimalarial measures. He recommends the use of sawdust soaked in oil, as this can be thrown by hand in somewhat inaccessible parts of ponds. The sawdust before treating should be dried, and answers better when derived from a soft rather than a hard wood. The sawdust and the oil should be mixed and allowed to stand for 24 hours.

A sack and ordinary engine waste soaked in oil and anchored in the bottom of a pond or stream is also advocated. The latter method the reviewer has tried and found to answer extremely well.

LE PRINCE (J. A.). **Fish as an Anti-Mosquito Agency.**—*Southern Med. Jl.* 1922. May. Vol. 15. No. 5. pp. 371-374.

The writer points out that most of the malaria in the Southern States is due to *Anopheles quadrimaculatus*, and that the top-feeding minnow (*Gambusia affinis*) is practically limited geographically to where these Anopheles breed. This fish is certainly a powerful agent in destroying these particular Anopheles. Goldfish are not as satisfactory on the whole.

The author makes the following suggestions for the control of malaria in the Southern States :—

1. That the value of *Gambusia* as an antimalarial agent should be published widely throughout the country.
2. Each medical officer should make it his business to have his own fish hatchery.
3. Small demonstration tanks stocked with fish should be placed in prominent parts of towns, so that the people could observe the fish and make use of them in destroying Anopheles. This was done in Tampico in Mexico. It is also suggested that a small aquarium for the same purpose should be used in schools as an educative measure.

WU LIEN TEH. **North Manchurian Plague Prevention Service. Summary of Ninth Annual General Report, 1921.**—*Nat. Med. Jl. China.* 1922. Mar. Vol. 8. No. 1. pp. 58-64.

Two limited outbreaks of plague occurred, one in August at Daurija, with four deaths, and another in October at Mouline, with seven deaths.

The first of these was the result of two railway employees skinning a tarabagan. The Russian doctor operated on the cervical bubo, believing it to be an abscess ; he himself was infected with plague and died in a few days.

The second outbreak was caused in the same way by skinning a sick tarabagan.

The investigations to ascertain the incidence of plague amongst the Siberian marmots resulted in three dead tarabagans being found in one field. Bacteriological investigation showed they had died of plague. The disease is apparently kept alive in this part of the world by the enzootic amongst the marmots.

It would be interesting to know whether the relation between climate and plague described by KUNHARDT and CHITRE is similar in this part of the world.

BULLETIN DE L'OFFICE INTERNATIONAL D'HYGIÈNE PUBLIQUE. 1922.
May. Vol. 14. No. 5. pp. 535-546. —**La lutte contre la peste au Sénégal.**

This is an extremely interesting paper because it gives an account of the experiences of practically every government which has been faced with the problem of eradicating plague from an agricultural population in the tropics. The writer of this review was himself one of the first officers to be detailed for plague duty in India in the year 1898. The paper describes the earlier measures, such as isolation of the sick and contacts, quarantine measures, the disinfection of houses, etc., all practically useless from the point of view of eradicating the disease.

When this fact was recognized serious attention was turned to the problem of reducing the rat population. The writer's description of the efforts made in Senegal repeat almost exactly the experience of Indian officers. It would seem in the matters of the use of poisons and traps, etc., that the writer is not acquainted with the more recent work of the Plague Commission, particularly that of KUNHARDT and CHITRE.

The final conclusion of the paper is that it is very important to create a permanent service for "deratization" under the Health Department. With this we are inclined to agree, provided that educating the people in the necessity of keeping rats out of their houses and the building of rat-proof shops, grain stores, docks and warehouses form the more important portion of the activities of this department.

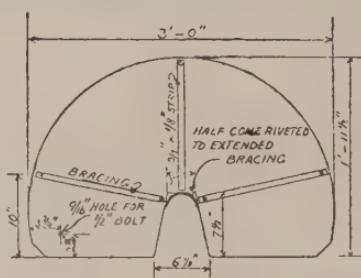
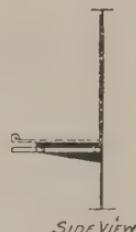
We have always maintained that the annual slaughtering of a large number of rats in a sparsely populated agricultural district is beyond the financial capacity of any government, and the influence on human plague is not proportionate to the funds expended.

RUCKER (W. C.). **The Panama Canal Rat Guard.**—*Public Health Rep.* 1922. May 19. Vol. 37. No. 20. pp. 1207-1209. With 1 plate & 1 fig.

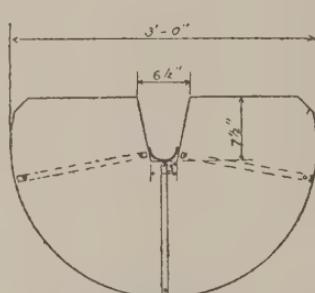
The writer gives an interesting plan and picture of what is known as the Panama Rat Guard; a lengthy explanation is not required. The two halves of the guard are lashed together with a lashing that is kept permanently attached to the top half.

Rat guards may be useful on ships' cables, but as soon as the vessel goes alongside and gangways are placed between the ship and the shore it is practically impossible to keep ships' rats on board or shore rats off the ship.

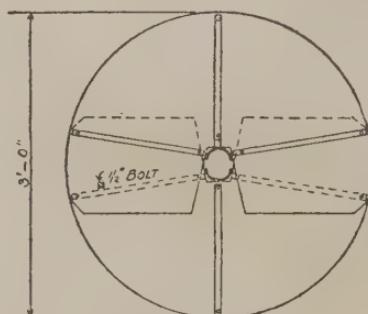
Material.	Cost.
26½ lb. (one-half sheet) iron; galvanized, 36 by 96 in., 18 gauge, at \$8.64 per cwt.	\$2.29
4lb. (12 ft.) strap iron, galvanized, ½ by ¾ in., at \$11.63 per cwt. . . . .	.47
20 rivets, ¼ by ½ in., galvanized . . . . .	.05
6-ft. rope, ¼ in... . . . .	.06
	<hr/>
	\$2.87
Labour	1.83
	<hr/>
Total	\$4.70

UPPER SECTION
FRONT VIEW

SIDE VIEW

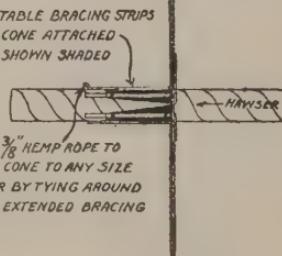
LOWER SECTION
FRONT VIEW
PATTERN SAME AS UPPER SECTION

SIDE VIEW

ASSEMBLED GUARD
FRONT VIEW

ADJUSTABLE BRACING STRIPS
WITH CONE ATTACHED
CONE SHOWN SHADED

SPLICE $\frac{3}{8}$ " HEMP ROPE TO
ADJUST CONE TO ANY SIZE
HAWSEY BY TYING AROUND
ENDS OF EXTENDED BRACING



SIDE VIEW

DETAILS OF PANAMA CANAL RAT GUARD

L.H.WILDER.

FIG. 94.—Details of Panama Canal Rat Guard.

[Reproduced from *Public Health Reports.*]



FIG. 95.—The Panama Canal Rat Guard. The strap-iron reinforcements give it rigidity and hold it perpendicularly to the line. The lashing is a permanent part of the guards, and the half-cones make it fit any line accurately. It is easily and quickly applied and light enough to facilitate handling.

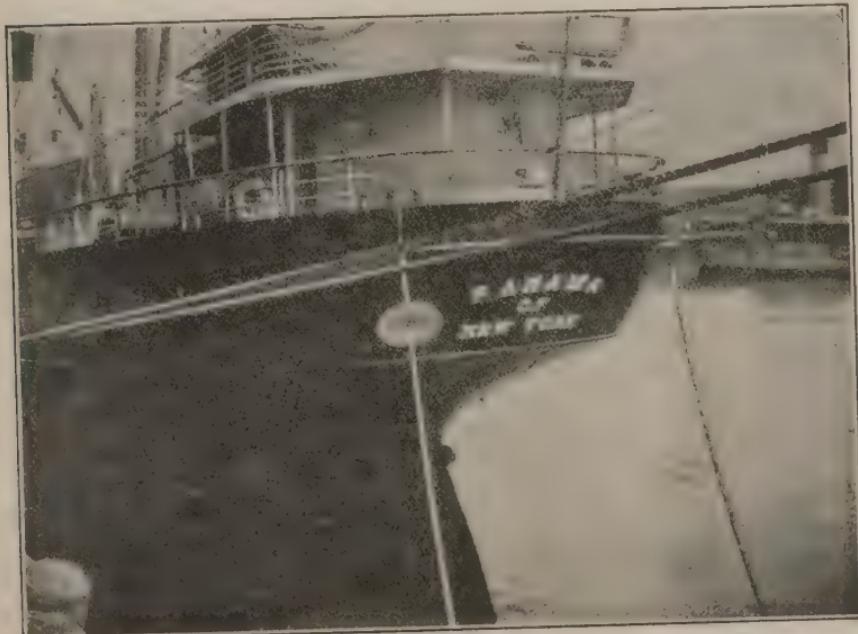


FIG. 96.—Panama Canal Rat Guard at left; ordinary rat guard at right.
[Reproduced from *Public Health Reports*.]

- i. WRESCHNER (Hans). **Ueber Missstände und Gefahren bei dem Verkehr mit bakteriellen Ratten- und Mäusevertilgungsmitteln.** [Abuses and Dangers in the Trade in Bacterial Exterminants of Rats and Mice.]—*Ztschr. f. Hyg. u. Infektionskr.* 1921. Vol. 93. No. 1. pp. 35-42.
- ii. WILLFÜHR & WENDTLANDT. **Ueber Massenerkrankungen durch Ratinkulturen.** [Mass Infections by Cultures of Ratin.]—*Ibid.* 1921. Vol. 94. No. 2-3. pp. 192-199.
- iii. RAEBIGER (H.) & BAHR (L.). **Ueber Missstände und Gefahren bei dem Verkehr mit bakteriellen Ratten- und Mäusevertilgungsmitteln. Bemerkungen zu den Artikeln von Wreschner, Willfähr und Wendtlandt (diese Zeitschr. Bd. 93, s. 35 und Bd. 94, s. 192).** —*Ibid.* 1922. Vol. 95. No. 4. pp. 442-445.

i. The author tested 51 samples of 17 different trade preparations for the extermination of rats and mice by seeding Drigalski plates. In only ten of the samples did bacilli of the paratyphoid and Gärtnner groups grow, and in only four was the culture a pure one. It is commonly believed that these preparations are harmless to man, but references are given to publications which testify to the contrary, and three new observations of illness and death occasioned by "Ratin" and "Rattentypus" are given. The author suggests the prohibition of the public sale of these viruses and of their use in all dwellings and buildings in which food is stored or prepared.

ii. Three instances are given in which Ratin was consumed by man with resulting illness or death; the last was the subject of careful investigation. At an orphanage in Brandenburg 95 children and attendants were seized with illness on two successive nights—fever, vomiting and diarrhoea, and in some instances alarming heart weakness; there were no deaths. Investigation showed that the rat baits were prepared on the kitchen table and laid out in various parts of the room, and bacteriological examination of a sample of the "Rattentypus" used showed a strain of bacteria corresponding in biological and agglutinative reactions to *B. enteriditis*, Gärtnner. The sera of 69 of the patients was tested against the bacillus and 84 per cent. agglutinated it in dilutions, shown in a table, which to the author is confirmatory of their specific association. It is concluded that the use of Ratin bacilli and the Gärtnner bacilli for extermination of rats and mice is very risky (bedenklich) for man.

iii. These authors express general agreement with WRESCHNER and state the case for Ratin. This preparation has been used in Scandinavia, Germany, England and Switzerland since 1904 in large quantities without harm to adults, domestic animals or older children, and with only a few cases of transient illness in the case of young children and suckling calves. In one of WRESCHNER's cases of death from Ratin the culture had been eaten in potatoes in large quantities by starving Russian prisoners—a concurrence of unusual factors—and whether Ratin really was concerned is doubtful. In the epidemic reported by WILLFÜHR and WENDTLANDT the culture incriminated was "Rattentypus" and not Ratin at all, so that their paper is misnamed. The rational process is to use a chemical as well as a bacterial poison, because some rats are immune to the latter, and this is the basis of the present Ratin process. [See this *Bulletin*, 1922, Sanitation Supplement No. 1, p. 15.] Ratin is the product of a particular laboratory and is a trade name which cannot be used for products of other laboratories.

SCHWARTZE (E. W.). [The Relative Toxicity of Strychnin to the Rat.]—*U.S. Dept. Agric. Bull. 1023.* 1922. 19 pp. [Summarized in *Experiment Station Record.* 1922. May. Vol. 46. No. 7. pp. 654-655.]

This article points out that *Mus norvegicus* tolerates as much as 3·0 to 3·5 mgm. per kilogram of strychnine when given subcutaneously.

"The practically certain oral lethal dose of strychnin is from 20 to 25 mg. per kilogram of the free alkaloid, equivalent when calculated as the sulphate to from 25·6 to 32 mg. The ratio of the subcutaneous lethal doses to the oral lethal doses is about 1 : 8 or 1 : 9. The reason for this high ratio in rats would seem to be that when less than a lethal dose has been given the stomach and its contents directly or indirectly hinder absorption. On this account the animal can prevent the accumulation of a lethal amount within the system by the rapid disposal. When a lethal dose is administrated by mouth the fatality usually occurs within several hours. The rat, therefore, must be overwhelmed by the drug; otherwise, it probably will survive. At times this certainly involves the play of a usually subordinate function, gastric absorption.

"Mice are more susceptible to strychnin than rats, both to subcutaneous injections and to doses orally administered. Ground squirrels (*Citellus richardsoni*) are about four or five times more sensitive to strychnin administered subcutaneously than rats. This helps to account for the comparative difficulty in poisoning rats.

"The percentage of strychnin which would make a successful rat bait cannot be stated at present. After the factors of rapid consumption and palatability are solved, it should be possible to obtain good results with 0·75 per cent. of the alkaloid in potent form in the formula. This percentage represents three times the fairly certain fatal dose in a meal of the average size."

SANDERS (G. E.). [Gopher Control by Means of Calcium Cyanid.]—*Agric. Gaz. Canada.* 1921. Vol. 8. No. 6. pp. 628-629
[Summarized in *Experiment Station Record.* 1922. Apr. Vol. 46. No. 5. p. 455.]

"During the course of experimental control work with the gopher at Carlyle, Sask., a comparatively new cyanid containing approximately 50 per cent. calcium cyanid and marketed in small flakes was found to give great promise. This cyanid is not nearly so deliquescent as sodium or potassium cyanids. Its physical form, as well as its chemical constitution, assist in its comparatively rapid decomposition when placed in contact with damp earth or less rapid on exposure to air. the products being hydrocyanic acid gas and hydrated lime.

"In testing its effectiveness, approximately 2·5 oz. of the material was inserted as far down the burrow as possible by means of a long-handled iron spoon, and weeds were then placed in the entrance of the burrow and covered with earth. Of 62 gopher burrows thus treated on July 11, not a single burrow had been opened 48 hours later. In another test, in which 69 burrows in heavier land were treated in the same manner but two had been opened 24 hours later. In a test where 12 burrow openings were treated with 1·5 oz. of the substance, only two had been opened 24 hours later."

The "Gopher" is the mole rat and belongs to the family Geomyidae. There are many species in Canada and they are common in wheat-growing districts.

DEL ROSARIO (S. V.) & LÓPEZ RIZAL (L.). Some Epidemiological Features of Cholera in the Philippines.—*Monthly Bull. of the Philippine Health Serv.* 1922. Jan. Vol. 2. No. 1. pp. 3-13.

This paper gives a very interesting résumé of the work done on cholera carriers and the agglutinability of certain strains of vibrios.

Carriers in general.—“ With respect to the incidence of carriers in general, little can be added to the provisional conclusions advanced in 1916 (Annual Report of the Philippine Health Service) as given below, except that the evidences gathered during the last four years tend to confirm such conclusion, especially as regards paragraphs (aa) and (cc) thereof :—

“ ‘ The epidemiological interpretation of the variable number of carriers in regard to any actual or threatening epidemic, as far as the experience of the service goes, is as follows :—

“ ‘ (aa) The presence of a comparatively great number of carriers is of decidedly favourable significance, as they represent the only available index of a condition of tolerance, if not of immunity (*immunitas non sterilans*, Ehrlich). This does not exclude the possibility of immune people existing showing no trace of being carriers.

“ ‘ (bb) The danger from a large number of carriers exists only when they are not kept in *isolation*, as in this case they would continue to be a menace not principally to themselves but to unaffected persons.

“ ‘ (cc) A comparatively small number of carriers, or the lack thereof, has no positive significance, except where coinciding with a great rise in the number of cases, in which event it may be taken as indicating that the process of natural immunization is either disturbed or stopped.’

“ The proposition has also been advanced in previous reports that the increased number of carriers in a locality at times coincides with and has a distinct bearing upon the occurrence of correspondingly increased number of cases. While this seems to have been the case during former years (1915-16), it has not been substantiated during the whole period of time covered by this investigation (1917-1918-1919-1920).”

Summary :—

“ The agglutinating property of cholera vibrios may be lost or regained under unknown circumstances in cases and carriers as well as *in vitro*.

“ 1. The loss of agglutinating property of any strain of cholera vibrios may be taken as an index of a condition of degeneration.

“ 2. The increased occurrence of non-agglutinating vibrio among cases and carriers means low case fatality.

“ 3. The higher the percentage of non-agglutinable vibrio carriers among total carriers, the lower the incidence of cases.

“ 4. The low fatality registered among cases with agglutinable vibrios coinciding with a high percentage of carriers with non-agglutinable vibrios means also a certain degree of degeneration of spirilla although not so clearly discernible as is the case with typical non-agglutinable vibrios.

"The greater or lesser number of carriers in general occurring during epidemics has no bearing upon the epidemiology of cholera, except as pointed out in our paragraphs marked (aa), (bb) and (cc) above quoted.

*"Practical Conclusion.—*In a thorough survey of cases and carriers of cholera as a part of the preventive campaign against the disease, it would be unwise to ignore or disregard the existence of the so-called 'non-agglutinable vibrios,' and failure to isolate, quarantine and disinfect persons or things so infected or liable to such infection would be a distinctly dangerous omission."

With the last conclusions all sanitarians who have any experience of this disease will certainly agree. There is another point which is of interest, namely, that most waters which contain non-agglutinable vibrios give rise to an increase in the number of bad types of diarrhoea.

DALE (John). **Flies on a Sanitary Site and Typhoid in a Boys' Home.**

—*Med. Jl. Australia.* 1922. June 24. 9th Year. Vol. 1.
No. 25. pp. 694-695.

This article is particularly interesting from two points of view. The author gives a graphic description of one of the unfailing results of disposal of night soil by trenching, namely, that the trenching ground breeds millions of flies; as he points out, the excreta are exposed to flies in the latrines, where the eggs are laid, and, provided the climatic conditions are suitable and the ground is soft and sandy, millions of flies hatch out after burying the night soil.

The author describes his trenching ground as being black with swallows catching the flies as they appeared from the ground. Everybody in the tropics has had similar experience, except that other birds than swallows sometimes appear.

There are two ways of getting rid of this state of affairs. One is to cap the trenches with a layer of about 6 in. of tenacious clay, which is rammed with a hand rammer. This effectually prevents the flies from making their way out of the ground. It is, however, a counsel of perfection in many places, because the cost of labour for ramming the clay is considerable and a suitable quality of clay is not available.

The second method mentioned by the author is the use of arsenite of soda, which he appears to think is open to objection. The best form of trap is probably the roller towel type and not the sprinkling of the material over leaves. We do not see any objection to using this substance on the trenching ground, because no ordinary person will visit this neighbourhood if he can avoid it; we have never had any accidents ourselves after many years' use of the poison.

The second part of the article describes an outbreak of enteric in a Boys' Home situated a few hundred yards from the trenching ground. There were 98 boys in the Home, with a staff of nine adults. The main part of the epidemic occurred between March 18 and March 29. A carrier of the *Bacillus typhosus* was found amongst the boys and it was shown that this individual had been recently employed on the work in the dining room.

The author thinks that some of these cases were probably infected by flies. Personally we consider that the presence of the carrier is quite sufficient to explain the outbreak. There is, however, no doubt that the close proximity of the trenching ground is a very serious menace to the health of the institution.

BRITISH GUIANA. **The British Guiana Society for the Prevention and Treatment of Tuberculosis. Fifteenth Annual Report, 1921.** [MINETT (E. P.), Hon. Secretary.]—18 pp.

This small pamphlet gives the history of the activities of the society in 1921. The figures show a decided but slow decrease in the prevalence of the disease. One does not expect spectacular improvement in a disease like tuberculosis.

The tubercular death rate for British Guiana as a whole in 1911-15 was 1·82 per mille; in 1921 it was 1·52. The improvement in Georgetown is more marked: in 1911 it was 3·1, in 1921 it was 2·4.

The proportion of deaths due to tuberculosis per 1,000 of all causes is in 1920 for British Guiana 52·2 and for Georgetown 86.

The total number of patients attending at the dispensary was 654, of whom 72 were proved to have tuberculosis. In all 1,581 visits were paid by the Health Visitor. 3,913 pints of milk were distributed to needy patients.

RUCKER (W. C.). **Alastrim.**—*Public Health Rep.* 1921. Dec. 9. Vol. 36. No. 49. pp. 3023-3027.

A detailed history of the symptoms, etiology, diagnosis, treatment, etc., of this disease. We do not propose to go into the difference between this and smallpox, but it may be briefly stated that the malady resembles a mild attack of smallpox somewhat modified by vaccination. The writer, however, considers that from the point of view of public health alastrim should always be diagnosed and reported as smallpox.

"The gentleness of the stages of invasion and eruption, the absence or vagueness of the umbilication, and the general absence of destructive processes are all indicative of alastrim. The mildness of alastrim, even in an extensive epidemic, is distinctive. In a warm climate, at least, 'alastrim' runs true to form and does not seem to increase in virulence."

The editor's note on the paper is important.

"Leake and Force, of the United States Public Health Service, in their studies on the immunological relationship of alastrim (1921), inoculated monkeys and rabbits, using crusts and pustule contents from alastrim patients in Jamaica and Haiti. They summarized the results of their experiments as follows:—

"A vesico-papular eruption was produced in monkeys by inoculation both with crusts and with vesicle contents from alastrim patients. The animals were protected against reinoculation with alastrim and vaccine virus. Rabbits inoculated with alastrim showed no eruption, but were almost completely immune to vaccine virus. Rabbits previously inoculated with vaccine virus gave positive intracutaneous reactions to smallpox crusts, alastrim material, and vaccine virus, but remained negative to chicken-pox crusts.

"The fact that definite immunity to vaccinia is produced by previous inoculations with alastrim is additional evidence of the essential identity of alastrim with smallpox."

- i. GILL (C. A.). **Relapsing Fever in the Punjab. (A Preliminary Report.)** *Indian Jl. Med. Res.* 1922. Apr. Vol. 9. No. 4. pp. 747-780. With 3 charts and 4 maps.
- ii. CRAGG (F. W.). **The Epidemiology of Relapsing Fever in India.—** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1922. Feb. 16. Vol. 15. No. 8. pp. 236-252. [Discussion, pp. 252-256.]

i. The author gives an extremely interesting and condensed account of the outbreaks of relapsing fever which have occurred during the last 50 years in the Punjab. By plotting fever figures for 1920 (see fig. 97) there was found :-

"(1) An almost complete absence of the usual autumnal rise in 'fever' deaths; (2) a phenomenal rise in the 'fever' deaths during May and June; (3) a relative rise, as compared with the three preceding months, in the fever mortality in the month of December."

It was established that a severe and widespread epidemic of relapsing fever occurred in the Punjab in 1920, which occasioned a mortality of no less than 26,000 souls. The investigation of this fact forms the subject of the article under review. The second portion gives an interesting account of the method of recording vital statistics in India generally and particularly in the Punjab, and criticizes the results of the figures available. It is not necessary to go into detail as regards this, as it is well known to most.

The substance of the author's findings is given in the following quotations.

"Amongst epidemic diseases almost exclusively classified under this head [Fever] in the Punjab are malaria, influenza, typhus, relapsing fever and enteric fever."

"Thus, in the Punjab, cholera is well known to be a hot weather disease which attains its maximum usually in the months of July or August. Smallpox is usually most fatal in the months of May and June, bubonic plague in March and April, malaria in October and November, and 'respiratory diseases' (mainly pneumonia) in December and January. Influenza is characterized by a spring and autumnal periodicity, which is also the main season of mortality recorded under the head of 'dysentery and diarrhoea.' Relapsing fever, whose epidemiology will be more fully dealt with later, is a spring disease, which in the Punjab is more especially associated with enhanced mortality in the months of May and June. Finally, pneumonic plague and typhus are cold weather diseases, whilst enteric fever, which so far as is at present known is not a serious cause of mortality, is mainly encountered in the autumn."

"In spite of limitations it is held that the vital statistics of the Punjab, if rightly considered and if properly utilized, are capable of throwing considerable light on the incidence of the many epidemic diseases which form so prominent a feature in the pathology of the Province."

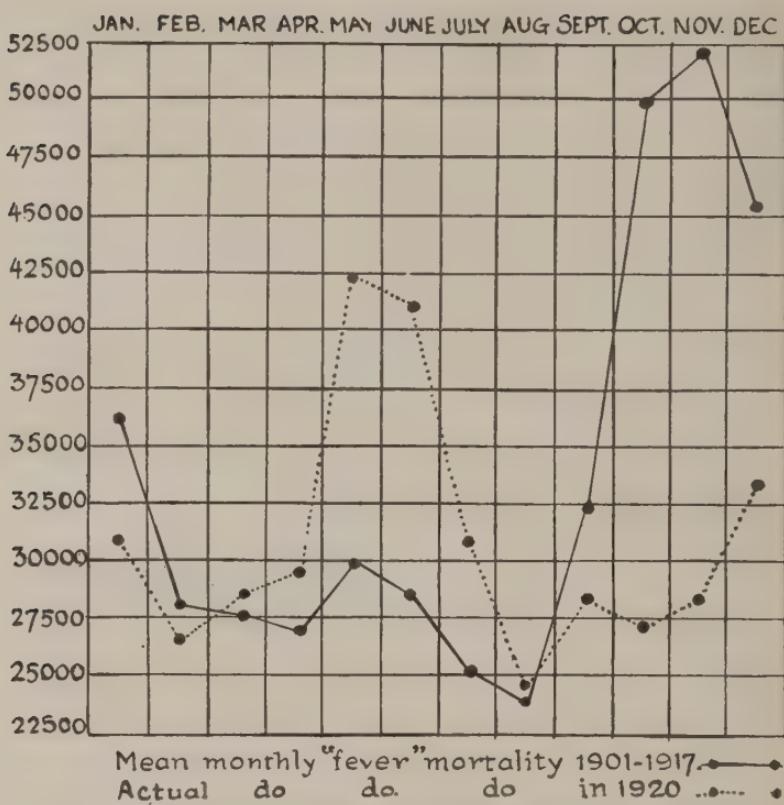


FIG. 97.—The Provincial Monthly "Fever" Mortality in the Punjab.

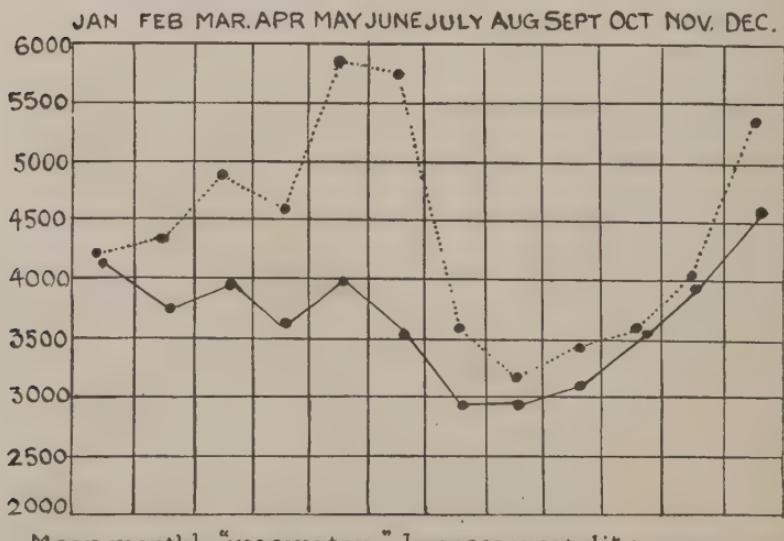
Mean monthly "respiratory" diseases mortality 1901-1917 —●—
Actual do do do do in 1920●.....

FIG. 98.—The Provincial Monthly "Respiratory Disease" Mortality in the Punjab.

The author then very carefully analyses the fever figures for the Punjab for evidence of outbreak of the fever. He points out that :—

"There is a marked association between epidemics of typhus and relapsing fever, although the former disease in the tropics and sub-tropics is essentially confined to localities exhibiting relatively cold climatic conditions. In such areas it is mainly a winter disease. Typhus fever, therefore, exhibits the same cyclical periodicity as relapsing fever, but a different seasonal periodicity and a more restricted geographical distribution."

From a careful scrutiny of the figures the writer points out that it is possible to make both a "fever index of the relapsing fever" and a "respiratory index of relapsing fever." He describes how these are calculated.

"To obtain an index figure representative of the relative severity of the disease the percentage increase in the 'fever' mortality in May and June over that recorded in March and April has been calculated. It is found that in normal years this figure, which will be termed '*the fever index of relapsing fever*,' varies between 5 and 10, whilst in years when relapsing fever is known to prevail in epidemic form it may be as high as 80, or more."

"A similar index can be calculated on identical principles in the case of deaths classified under the head of 'respiratory diseases.' This index it is proposed to term the '*respiratory index of relapsing fever*.' It is indicative of and dependent upon the fact that an enhanced mortality from pneumonia during May and June is for the most part attributable to relapsing fever.

"It is found that under normal conditions the mortality from respiratory diseases during March and April exceeds that recorded in May and June by about 10 per cent. In other words, in the absence of relapsing fever, the respiratory index is approximately -10. In the presence of an epidemic of relapsing fever the position is reversed, the deaths recorded under the head of 'respiratory diseases' in May and June exceed those reported in March and April, and the respiratory index, instead of being a *minus* quantity, becomes a *plus* quantity.

"An '*intestinal index of relapsing fever*' can be calculated on similar lines, but the figures for the diseases classified under the head of mortality due to 'dysentery and diarrhoea' being relatively small, it has not been considered expedient to determine this index.

"To sum up it is concluded that the epidemiological criteria of relapsing fever, the combined presence of which is essential to establish the occurrence of the disease in epidemic form in the Punjab, are as follows :—

"(1) The absence of any other epidemic disease in the spring and the presence of a febrile disease, which on investigation in selected localities, can be shown on clinical and on microscopical grounds to be relapsing fever.

"(2) A 'fever' index of relapsing fever markedly in excess of normal.

"(3) A respiratory index of relapsing fever exhibiting a *plus* instead of a *minus* quantity."

The next portion of the report describes what actually occurred in 1920 and the distribution of the outbreak in 1917, 1918, 1919 and 1920. The fever index of relapsing fever in 1920 was 44·2, which has only four times been exceeded in the last 54 years. The respiratory index was 21·8, and the mortality due to the outbreak ascribed to relapsing fever in May and June is at least 26,000, and with proper corrections it may be as much as 37,000; but considering this outbreak really lasted from 1917 to 1920, the death-rate was probably 60,000 in all. This would mean that at least 370,000 cases actually occurred.

The writer then goes on to review the history of the disease since the year 1867. His general conclusion is given as follows:—

"It will be seen from a scrutiny of chart 3 that the occurrence of major epidemics of the disease, as indicated by the 'fever' indices, took place in the years 1869, 1878, 1891, 1906 and 1920. The respiratory indices are not available for the period 1872-1905, but in the years for which they are available (1869, 1906 and 1920) they afford confirmatory evidence of the occurrence of an epidemic of relapsing fever in these years.

"The contemporary records contained in the Punjab Sanitary Reports, it has already been shown, refer to widespread outbreaks of relapsing fever in the years 1869, 1878, 1891 and 1920, and it is equally important to note that they make no mention of epidemics in any other years."

The conclusions of these annual investigations are given briefly below.

"Nevertheless, the available information suffices to show that relapsing fever has exhibited some degree of epidemicity in at least 27 years out of 54 years.

"Unless therefore it be assumed that the disease is constantly being imported from other parts of India, it must be concluded that relapsing fever is a disease which is permanently (at any rate since 1867) endemic in the Punjab and that the periodical epidemics are due to the increased toxicity and enhanced diffusibility of an endemic disease.

"Another notable feature of these epidemics is their frequent though not invariable association with famine. Thus famine preceded and accompanied the epidemics in the years 1869 and 1878. The minor epidemic of 1900—if, indeed, the high fever index in this and following year is indicative of relapsing fever—was also associated with famine.

"On the other hand scarcity did not prevail either in 1906 or in 1920.

"The history of relapsing fever in the Punjab also serves to illustrate the well-known association of relapsing fever and typhus.

"Thus during the quinquennium embracing the year 1869 numerous outbreaks of typhus were reported from the districts in the north and west of the Province.

"This disease was also prevalent during the epidemic of relapsing fever in the year 1878, the same area as before being mainly involved. Identical circumstances occurred in connexion with the relapsing fever epidemic based on the year 1891.

"There is no mention of typhus in connexion with the epidemics of 1900 and 1906, but typhus fever is again reported in association with the present epidemic of relapsing fever (1918-20)."

We regret that we are unable to publish the very interesting maps. All Indian officers and those interested in relapsing fever should obtain the article in the original.

ii. It is fortunate that these two papers can be placed side by side. The second gives a description of the same epidemic of relapsing fever as described in the first paper, only Major Cragg's work was carried out in the United Provinces, whereas Col. GILL's was in the Punjab.

The author, during his service, has specialized in matters entomological; he therefore approaches his work at a slightly different angle from Col. GILL. He deals more fully with the life-history of the pediculus and how it is influenced by climatic conditions.

He describes the conditions amongst the population in the United Provinces and shows that personal cleanliness has not reached that point at which man ceases to harbour pediculi in his clothing. He then follows much the same direction as the preceding paper, describing Vandyke CARTER's work and giving a brief description of the method of registration of the vital statistics in the United Provinces.

"The mean annual death-rate in the United Provinces for the 20-year period 1898-1917 was 36.27; the lowest rate was 27.38, the highest 52.73, the high rates being due entirely to prevailing epidemics. The most important diseases are, of course, plague, cholera, and malaria; smallpox is now relatively unimportant, vaccination being an established and not unpopular institution. The seasonal prevalence of these diseases is an important point, particularly in the case of plague, as it happens that the plague season is near that of relapsing fever. Plague is at its lowest in July and August; the death-rate from this disease rises during the cold weather, and reaches its highest point in March or April, according to the climate of the locality. Relapsing fever epidemics rise and fall about a month later than epidemics of plague."

From this he proceeds to describe an outbreak in 1917.

"In the first quarter of 1917 the death-rate was practically normal. In April, however, there was a very definite rise, which was almost maintained in May. There was not enough plague or cholera reported to account for this. The death-rate in the following months ran parallel with the mean, but was maintained above it till September. It is necessary to remark here that the autumnal rains failed in 1917, and that there was therefore little malaria. A sharp rise in December brought the death-rate to about 50 per cent. higher than in the first month of 1917. This rise was maintained in January and from March the rate rose so sharply that in May, 1918, the death-rate was about 75 per cent. greater than the mean for that month. Thereafter the death-rate fell steadily until it reached the mean in August. We cannot follow the epidemic of relapsing fever through the rest of 1918, or in 1919, on account of the prevalence of influenza, which obscured all traces of other epidemics. The year 1920 was a most exceptional one, in that very little plague or cholera was reported. Relapsing fever was, however, still prevalent, and shows itself in a rise in May and June, rather later than usual." He points out that the more prosperous districts apparently suffered most. As regards the seasonal prevalence the most striking feature of the epidemic was the special incidence on young adults.

"By the use of a method based on the seasonal prevalence and the special age incidence of the disease, I was able to estimate the relative

severity of the disease in any district, irrespective of the total death-rate, which might, of course, be raised by an epidemic of another disease. I may add that I found this method most useful in the analysis of the statistics of past years, and by its aid was able to define an epidemic in 1896 which passed unrecorded at the time. The method fails in the presence of much cholera, and only one of the factors could be used in the years 1918 and 1919, on account of the prevalence of influenza."

The author does not consider that there is any evidence to show that the disease was imported from outside. In the year 1918 there was a considerable scarcity owing to the failure of the monsoon in 1917.

He then gives a description of the experimental work, particularly the inoculation of monkeys. Many difficulties had to be overcome, the scarcity of monkeys, the difficulty of carrying about infected lice during the hot weather—this was actually done in wristlets. Apparently little success resulted from the experiment until the author himself contracted the disease, when 2 cc. of his blood containing spirochaetes was injected into a monkey.

The results of his experiment on dissection of lice are as follows :—

"The dissection of lice from cases of the disease, and after a single feed on an infected monkey, gave a more satisfactory confirmation of the work of the French investigators. The insects were dissected at intervals of from 2 to 17 days after the last infecting meal. Of 67 lice from cases of the disease or from convalescents, spirochaetes were found only in those of the 7th and 11th days. Of 58 lice which had fed once on an infected monkey, spirochaetes were found in those of the 8th, 9th and 11th days."

The author then deals with the subject of the bionomics of pediculus.

"The normal mean maximum temperature in the United Provinces in January, the coolest month, is 73° F.; in February, 77·4° F.; in March, 89·8° F. The hot weather may be said to begin about the middle of April, the normal for this month being 100·8° F. May is the hottest month, with a normal of 104·9° F. Towards the end of June there is an increase in atmospheric humidity owing to the advance of the monsoon, and the mean for this month is 101·3° F. There is thus a difference of about 30° between the maximum temperatures of the coolest and the hottest months.

"In the cold weather, when the atmospheric temperature is definitely lower than the body temperature, the bionomics of pediculus are the same in India as in Europe. The warmth of the body is necessary to it. Development is retarded if it is separated from its host at night. But as the temperature rises rapidly at the end of March and in April, the conditions are changed. The temperature and humidity of an ordinary Indian house become practically the optimum for this insect. It is to be noted that atmospheric conditions are far more important to lice living on the lightly clad Indian than they are when the host is a European, with many thicknesses of cloth between the skin and the external air. When, therefore, the temperature of the air approximates to that of the body, there is no slowing down of the metabolism of the insect if temporarily separated from its host. It becomes an exceedingly active insect. In one experiment which I carried out

to test the reaction of lice to sunlight, the insect travelled altogether 32 ft. 6 in. on a sheet of Bristol board, on one run achieving 17 in. in a minute, a speed far greater than previous records. Eggs are laid more freely, the incubation period is shortened, and the period of growth is reduced. As the season advances, however, the optimum is passed, and the more rapid metabolism is associated with an increased mortality. Towards the end of April and in early May the lice begin to die off, and I found in the United Provinces, as was found in Mesopotamia, that they become very scarce when the hot weather has set in.

"The application of this to the seasonal prevalence of relapsing fever needs little comment. The rise and fall of the disease is apparently determined by much the same climatic conditions as control plague, but, owing to the longer incubation period, the greater duration of the disease before death, and the period which must elapse before the louse becomes infective after the infecting meal, the death-rate from relapsing fever rises and falls later than that from plague by about a month.

"The explanation [of the outbreak] when one has arrived at it is very simple. The year 1917 was an altogether abnormal one. In the first quarter of the year there was nothing very unusual in the climatic conditions, but in April the mean maximum temperature was only 95° F. against a normal of 100·8° F. In May it was 95·5° F. which is nearly 10° below the normal. In June there was a deficiency of 3·3° F. The atmospheric humidity was in each of these months correspondingly high. The bearing of this on the incidence of relapsing fever is clear. The period during which optimum conditions for pediculus prevailed was greatly extended, and the natural delousing which takes place in a normal May was greatly reduced."

The author points out that the weather conditions of 1917 were officially described as "unique" and compares the figures of those of 1877, 1878 and 1885. 1877 and 1878 were both of them notable as being years of great prevalence of relapsing fever.

At the conclusion of the paper Major H. C. BROWN made the following remarks, which we consider of importance.

He points out that during the harvest period a small pentatomid is extraordinarily common on the threshing floors and that this bites the legs of people employed. It is possible that this insect may also be a factor in the spread of the disease.

When in the fields at work the people make great piles of their clothing and it is easily understood the opportunity this offers for disseminating the disease, particularly amongst the young and active males.

Major BROWN wrote an interesting account of an outbreak of relapsing fever investigated by himself in the Meerut district in the year 1913. In spite of the fact that the spirochaetes were seen in the blood of several of the patients, suffering from the disease, the report was never published, as it apparently displeased the executive head of the department at the time.]

CORT (W.), ACKERT (James E.), AUGUSTINE (Donald L.), PAYNE (Florence King) & PAYNE (George C.). **Investigations on the Control of Hookworm Disease.**—*Amer. Jl. Hyg.* 1921. Sept.-Nov. Vol. 1. Nos. 5-6. pp. 557-568; 1922. Jan. Vol. 2. No. 1. pp. 1-16. With 2 text figs.; pp. 17-25; pp. 26-38; pp. 39-50; Mar. Vol. 2. No. 2. pp. 107-148. With 3 charts, 10 figs. & 1 plan; pp. 149-161. With 1 chart & 4 figs.; pp. 162-171; pp. 172-176; pp. 177-187.

All these papers are of very great importance from the point of view of the sanitarian who is attempting to eradicate hookworm disease; the investigation has been carried out in a thorough manner and all interested in this subject should obtain reprints of the papers. Unfortunately the most we can do is to give a few extracts dealing with the more important aspects of the subject, and the authors' own résumé of the work.

I. General Introduction [CORT]. This paper is an introduction to the series. The author commences by saying: "As applied to control measures, the attempt to kill the parasitic stage of the hookworm includes (1) the recognition, usually by fecal examination, of the individuals who harbour the parasites, (2) the administration of an anthelmintic to infested individuals, (3) the re-examination after treatment to discover if the worms have been dislodged, and (4) the retreatment, until the examination becomes negative, of those individuals who are still infested. The killing of the hookworm eggs can be accomplished immediately by disinfection of the feces containing them, or by the prevention of the deposition of feces by infested individuals under conditions where the eggs can hatch and reach the infective stage. This phase of the attack centres around the prevention of soil pollution, and is also effective in the control of other diseases, such as typhoid fever and the protozoan and bacillary dysenteries. The killing of the infective hookworm larvae may be accomplished directly by disinfecting the soil in which they live, or indirectly by preventing the human host from coming into contact with such soil under conditions which would make infestation possible."

He points out that many problems concerning the life-history of the hookworm are still unsolved, and lays down a programme of investigation work. The various points form the subjects of the following papers.

II. The Description of an Apparatus for Isolating Infective Hook-worm Larvae from Soil [CORT, ACKERT, AUGUSTINE & PAYNE (F. K.)]. *Authors' Summary.*—"The apparatus for isolating hookworm larvae from soil, described in this paper and shown in Figs. 1 and 2, which is similar to an apparatus devised by BAERMANN, makes it possible to isolate hookworm larvae from considerable quantities of soil.

"2. It is possible to distinguish mature hookworm larvae, both sheathed and unsheathed, from other nematodes found in soil by their characteristic structure and movement.

"3. For experiments with the isolating apparatus mature hookworm larvae were obtained by spreading feces containing hookworm eggs on soil in large pans and covering this with a thin layer of ashes.

"4. Experiments to standardize the isolating apparatus showed (1) that to isolate a satisfactory percentage of the larvae the water must be at least 10° F. warmer than the soil, (2) that a slightly

higher percentage of larvae can be isolated from moist than saturated soil, (3) that in soil with very finely divided particles the percentage of larvae which can be isolated is less than in coarser soils, and (4) that while most of the larvae escape from the soil into the water in the first six hours an appreciable number come out after this time.

" 5. It is probable that the passage of the larvae from the soil to the water is not a reaction to moisture or a higher temperature, but is brought about by the active larvae falling through spaces in the soil until they reach the water.

" 6. The isolating apparatus makes possible the study of soil nematodes, both free-living and the larvae of parasitic species, in their natural environment, and can be utilized in investigating the sources of human infestation in hookworm control work."

III. A Discussion of the Finding of Unsheathed Hookworm Larvae in the Soil [CORT, AUGUSTINE, ACKERT, PAYNE (F. K. & G. C.)].

Authors' Summary.—" 1. Although various investigators have reported that mature hookworm larvae lose their sheaths under certain conditions, it has been the general opinion that they live normally enclosed in sheaths.

" 2. It was found that in a series of soil samples examined from places polluted by people infested with hookworms a large proportion of the mature larvae were without sheath.

" 3. Also, in experiments on the conditions under which hookworm eggs hatch and develop and on the migrations of the infective larvae, it was found that in soil a large proportion of the larvae soon became unsheathed.

" 4. These findings suggest that it is a common thing for mature hookworm larvae to lose their sheaths and continue to live in soil.

" 5. Since most of the knowledge of the activities of mature hookworm larvae has come from studies on sheathed forms, it will probably be necessary to revise many of our ideas on the life of infective hookworm larvae in the soil."

IV. The Relation of the Domestic Chicken to the Spread of Hookworm Disease [ACKERT].

Author's Summary.—" 1. The length of time required for food material to pass through the digestive tract of chickens ranges from 2 hours and 40 minutes to 16 or more hours.

" 2. Hookworm eggs remain viable while passing through the alimentary canal of chickens and are able to hatch.

" 3. Hookworm eggs swallowed by chickens produce infective hookworm larvae when the fowl feces are mixed with animal charcoal or with soil.

" 4. The results of a series of experimental feedings indicate that the great majority of hookworm eggs ingested by chickens fail to produce infective hookworm larvae. This failure is attributed in part to breaking of eggs in the gizzard, injury from urine in the feces, and to malnutrition of the larvae in the excrement.

" 5. Dangerous infective spots may be established around drinking receptacles by chickens that have swallowed hookworm eggs day after day.

" 6. Hookworm eggs deposited out of doors under conditions unfavourable for development can be carried by chickens to favourable environments.

" 7. Human stools voided in unfrequented places can be transported by chickens to the door yard which is traversed by bare-footed persons.

" 8. Newly hatched hookworm larvae can pass through the digestive tracts of chickens apparently uninjured.

" 9. Sheathed hookworm larvae swallowed by chickens fail to pass at once through the fowls unaltered.

" 10. *Strongyloides stercoralis* larvae occurring in the human stools passed through the chickens and soon attain the infective stage, a single mature male of the free-living generation having been seen.

" 11. The various experiments first performed on adult chickens were later repeated with young ones with similar results in each case.

" 12. A comparison of the reduction of mature hookworm larvae by fowls with the establishment of infective spots by them convinces the writer that chickens are more beneficial than harmful in the control of hookworm disease in Trinidad."

V. The Domestic Pig and Hookworm Dissemination [ACKERT & PAYNE (F. K.)]. Authors' Summary.—" 1. Human hookworm eggs swallowed by domestic pigs produce infective larvae in five days during the rainy season in Trinidad.

" 2. The results of tests indicate that a high percentage of the hookworm eggs ingested by pigs are able to produce infective larvae, and that the free-range pig is an important factor in the dissemination of human hookworm eggs.

" 3. Infective hookworm larvae swallowed by pigs do not pass through unaltered in the excrement.

" 4. *Strongyloides stercoralis* larvae survive passage through the digestive tract of the pig and multiply in the faeces. Circumstantial evidence shows that the pigs became infested with this nematode.

" 5. A new species of hookworm, *Necator suillus*, is of common occurrence in the domestic pigs in Trinidad, British West Indies."

VI. A Study of the Effect of Hookworm Control Measures on Soil Pollution and Infestation in a Sugar Estate [CORT & PAYNE (G. C.)].

We particularly recommend this paper to the attention of all medical officers of tea estates, rubber plantations and all connected with labour-employed enterprises in tropical countries. The author's summary is given below, but the details of the work are full of interest and of great practical importance.

Authors' Summary.—" 1. An intensive epidemiologic study was made of an area with a high incidence of hookworm disease, in a sugar estate in Trinidad, British West Indies, to determine the exact sources of human infestation and to learn the effect on human infestation, soil pollution and soil infestation of a control campaign.

" 2. Of the 142 people, both East Indians and negroes, examined from the area chosen for study, 117 were found to be infested with hookworms.

" 3. A series of three treatments greatly decreased both the number of positives and the total mass infestation of these people.

" 4. Soil pollution was widespread and very gross in this area, being especially concentrated at certain easily accessible places in the cane field, to the west of the barracks, where the people lived.

" 5. Surveys of the pollution in the cane field showed a great reduction after the building of an adequate number of latrines and the carrying on of an educational campaign.

" 6. Examinations for infective hookworm larvae of soil samples from this area showed very little soil infestation, except along the heavily polluted strip of cane.

" 7. The records of the examination of the soil samples indicate that hard packed clay-loam soil on which there is no vegetation, even if moisture is present, does not offer conditions favourable for the development of hookworm larvae.

" 8. The localized character of soil infestation, especially in the cane field, showed that there was little migration of infective hookworm larvae from the places of development, although evidence is presented that they may be carried considerable distances by water.

" 9. The analysis of the habits of the people in relation to the distribution of soil infestation, suggested that most of the heavy infestation of the people of this area was due to the habit which so many of them had of visiting certain places in the cane field for the purpose of defecation.

" 10. After the reduction of soil pollution in the cane field and the treatment of the people of the area, series of samples taken at intervals showed a rapid dying out of the infective hookworm larvae from this area, so that in about six weeks soil infestation was practically eliminated."

VII. An Epidemiologic Study of Hookworm Disease in a Cacao Estate [CORT & PAYNE (G. C.)]. *Authors' Summary.*—" 1. Examination of the people living in three houses on a cacao estate showed a heavy infestation with hookworms.

" 2. Soil pollution in this area was almost entirely restricted to definite spots, 'natural latrines,' in the cacao grove, near the barracks.

" 3. The examination of soil samples showed very little soil infestation anywhere in the area, except at the 'natural latrines' in the cacao, and the conclusion can be drawn that almost all the human infestation must have come from the habit of polluting the soil of the cacao.

" 4. Even in the 'natural latrines' the findings were somewhat irregular, indicating the conditions were not always favourable for the development of hookworm larvae, and that they did not migrate from the place of development.

" 5. Examinations of the soil of the intensely polluted spots in the cacao six weeks after three routine treatments had been given to the people, showed a very marked reduction of soil infestation, indicating that in this situation the life of the infective hookworm larvae is short."

VIII. Experiments on the Migration of Hookworm Larvae in Soils [AUGUSTINE]. *Author's Summary.*—" 1. Experiments carried on in Trinidad, British West Indies, from May to September, 1922, showed that infective hookworm larvae placed on moist soils do not migrate in periods from 15 hours to 42 days.

" 2. Experiments show that hookworm larvae may be carried out from centres of soil infestation by surface water, and that they can establish themselves in the new locations when the water recedes.

" 3. Hookworm larvae were not found to migrate to favourable situations when their original environments become unfavourable.

" 4. Soil scraped from the shoes of men passing through infested areas was found to contain hookworm larvae. It is possible that paths leading to such areas, as well as the immediate surroundings of dwellings, become centres of infestation by the dropping of such soil.

" 5. During the time the larvae remained in the soil there occurred a reduction in their numbers, which increased with the number of days the experiment lasted."

IX. On the Position of the Infective Hookworm Larvae in the Soil [AUGUSTINE]. *Author's Summary.*—" 1. Infective hookworm larvae under optimum conditions of moisture and temperature were found to remain on and within the upper surface of the soil.

" 2. They creep up pieces of wood, decaying vegetation, and other objects, only as far as the film of moisture extends.

" 3. Hookworm larvae were not found within the drops of water collected in the axils of the leaves of green plants nor upon the leaves themselves.

" 4. At centres of soil infestation, where the surface is covered with leaves or twigs, the infective hookworm larvae were found extended from the leaves or twigs when moist, but in the soil beneath when dry."

X. Experiments on the Length of Life of Infective Hookworm Larvae in Soils [AUGUSTINE]. *Author's Summary.*—" 1. From the observations of various investigators on hookworm larvae under unnatural conditions, the opinion has become current that they live for months or even years in the soil, under favourable conditions of temperature and moisture.

" 2. Laboratory experiments carried on in Trinidad, British West Indies, from May to September, 1921, show that a rapid reduction in the number of hookworm larvae occurs in soils of various types, and that the extent of their life is limited to about six weeks.

" 3. The completion of the second ecdysis of the infective hookworm larvae in the soil presents a new factor in determining their length of life, which was not found to directly shorten the life of the larvae under favourable conditions, but renders them more susceptible when in unfavourable environments.

" 4. Experimental evidence indicates that the loss of sheath does not render the mature larvae non-infective, which would be the equivalent of their death.

" 5. The conclusion can be drawn that environmental conditions, such as tropical temperatures which tend to increase the activity of the mature hookworm larvae, will shorten their lives by the more rapid using up of the stored food material."

SMILLIE (Wilson G.). The Results of Hookworm Disease Prophylaxis in Brazil.—*Amer. Jl. Hyg.* 1922. Jan. Vol. 2. No. 1. pp. 77-95.
With 6 charts.

This is another extraordinarily interesting paper dealing with the results of a hookworm campaign in Brazil. The author commences by asking the following questions :—

" One of the big problems in rural sanitation which has occupied our attention is hookworm disease, and after four years of labour the following questions have most urgently presented themselves :—

" 1. Are the *results* of the intensive hookworm campaigns of permanent or temporary value ?

" 2. If the results of the campaigns are of temporary value only, for how long a time are the benefits of the campaigns appreciable in the betterment of the health of the people ?

" 3. At the present time we believe that the two most important factors in hookworm disease prophylaxis are intensive treatment and latrine construction.

" A. Which of the two is of greater relative importance ?

" B. What relation should one factor bear to the other, *e.g.*, which should have precedence ?

" The correct answers to these basic problems are essential if we are to carry through hookworm disease prevention to a successful conclusion."

As a result of four years careful work in Ilha do Governador, Rio de Janeiro, on 9,000 people (who gave originally 71·1 per cent. of infection with hookworm), consisting of intensive treatment and the installation of latrines in about 80 per cent. of the houses, the microscope showed that 70 per cent. still harboured hookworm.

There are three alternatives left to us in interpreting such discouraging data that have been accumulated and presented from various sources.

" A. Our knowledge as to the mode of spread of hookworm disease is at fault.

" B. Our methods used in combating the disease have been inefficient.

" C. The data from which we are drawing our conclusions as to our failure are incomplete and misleading."

In order to elucidate this rather extraordinary state of affairs, a careful re-survey of the inhabitants was inaugurated. The inhabitants were divided into three groups, as follows :—

" 1. A group in one of the villages consisting of families of fishermen, shopkeepers, dock labourers, street sweepers, etc.

" 2. A group from the zone between the village and farm, consisting of the families of market gardeners, day labourers, washerwomen, etc.

" 3. A group from the centre of the island, consisting almost entirely of the families of farmers and day labourers, many of whom had no latrines or did not use the one they had.

" Approximately equal numbers of men and women were chosen. There were people of all ages, of different race and colour, different occupations, social status, etc. The only factors in common to all were :—

" 1. They had lived on the island continuously since 1917.

" 2. They had taken hookworm treatment during the campaign three years previously.

" 3. They had taken no vermifuge since the campaign treatment three years previously.

" Results :—

" In all, 86 cases were carried to a successful conclusion. Four of these were controls ; *e.g.*, they had lived continuously on the island for more than two years, and had never taken hookworm treatment.

"The hookworm infection rate by the microscopic examination of the stools was as follows :—

Table I.

Results of the microscopic examination of the stools for hookworm ova, Ilha do Governador, July, 1921 :—

Sanitary campaign, I.H.B., 1917-18 ..	71.2 per cent.
Federal Government Dispensary, 1920-21 ..	70.0 ..
Our re-survey, Institute of Hygiene, July, 1921	69.0 ..

"The results of these microscopic examinations are apparently very discouraging, for we were able to verify the findings of the Federal Dispensary, namely, that the microscopic examination shows a diminution of only 1 or 2 per cent. in the hookworm infection rate on the island after four years of sanitary work."

The results obtained by the worm count method revealed quite a different picture.

Table II.

Results of worm count method, as an indication of the degree of hookworm infection, Ilha do Governador, July, 1921 :—

Total number of hookworms harboured, 86 cases ..	1,242 worms.
Average number of hookworms per case	14 ..
Total number of hookworms harboured, 4 controls ..	1,299 ..
Average number of hookworms harboured per case ..	324 ..

These figures are therefore the explanation of the problem, namely, that in the untreated population each person harboured 324 hookworms, in the treated population 14.

A re-survey of the island showed there were no cases of heavy infection that had been treated three years previously; 50 hookworms per man does not effect the haemoglobin index materially.

Table IV.

Table showing the maximum number of hookworms harboured in various age and sex groups on the Ilha do Governador :—

Adult males harbouring more than 50 hookworms ..	3 of 20
Adult females harbouring more than 50 hookworms ..	2 of 28
Boys, 8-15 years, harbouring more than 25 hookworms ..	4 of 15
Girls, 8-15 years, harbouring more than 25 hookworms ..	1 of 19

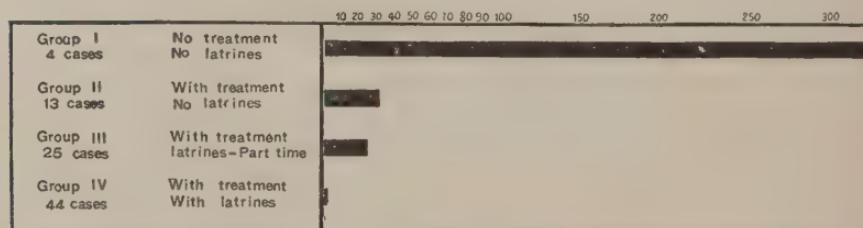


FIG. 99.—Sanitation of Ilha do Governador, Brazil. Chart showing average number of hookworms harboured by various groups of people.

[Reproduced from *American Journal of Hygiene.*]

Careful microscopic examination showed that the female worms were more numerous than the males.

Careful analysis of the population, divided into groups, as to whether or not they used latrines also shows some startling results, namely, that those who were treated and used latrines regularly had a negligible number of hookworms.

These figures were checked against similar results obtained in Jacarépagua. The population was a very poor class of market gardeners living under conditions highly suitable for infection with the hookworms. They were all treated two years previously and a re-survey was made on exactly the same lines as the Ilha do Governador.

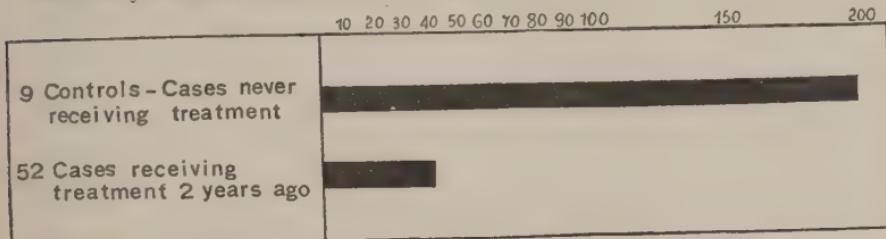


FIG. 100.—Sanitation of Jacarépagua, Brazil. Chart showing average number of hookworms harboured per individual in a zone of heavy infection two years after treatment.

[Reproduced from *American Journal of Hygiene*.]

Preliminary microscopic examinations showed that 83 per cent. were still infected. The result of hookworm count showed that the hookworms per individual was 42, whereas nine controls gave 198.

A study of the distribution of the reinfection by age and sex in 52 cases give some remarkable figures.

Table VIII.

Showing the degree of hookworm infection in the various age and sex groups in Jacarépagua.

	Number of cases.	Average age.	Average Number of hook- worms.	Percentage of cases harbouring 50 hook- worms or more (children 25 or more).
Adult Men ..	22	33	66	40
Adult Women ..	13	21	28	30
Boys, 8-15 years ..	10	11	36	20
Girls, 8-15 years ..	7	11	10	0

These show that the men and boys treated two years ago were slowly being reinfected with the worms and in girls the infection was materially less.

The author lays down the following arrangements as best suited for an ordinary campaign assuming that the infection is about 60 per cent. or 70 per cent. by microscopic test.

"A. The work should be begun by a general hookworm treatment campaign as at present; treating all positive cases twice and all soil workers three times, with a standard treatment of oil of chenopodium or other efficient drug.

"B. Coincident with the campaign, latrine construction should be instituted. This always takes more time than the treatment campaign for obvious reasons that do not need to be detailed.

"C. When the treatment campaign is completed withdraw all but a small nucleus, which shall continue fiscalization of latrine construction, and treatment of all newcomers."

In communities subject to very heavy infection, that is, up to 80 or 90 per cent. by the microscopic test, the following is laid down as the best procedure.

"1. The preliminary treatment campaign should be carried out as at present, giving three treatments of oil of chenopodium to all soil workers.

"2. The construction of latrines should accompany the treatment and should continue until 70 or 80 per cent. of the houses are sanitized. In each community this will require a considerable period of time—probably two or three years.

"3. When 70 or 80 per cent. of the houses have sanitary latrines, there should then be a second hookworm treatment campaign, giving every positive case a single treatment only. Special emphasis should be placed upon treating all *soil workers*.

"4. A small health unit should then be permanently maintained to fiscalize the construction and upkeep of latrines, treat newcomers, and serve as a basis for a future rural health unit."

The author says that although hookworm infection will not disappear, hookworm disease will; if latrine construction goes on the ultimate success of the campaign will be assured.

For the heavily infected population who will not use latrines a standard treatment every year gives good results; even one treatment every two years has been found in Brazil to be satisfactory.

PROPAGANDA.

MONTHLY BULLETIN OF THE PHILIPPINE HEALTH SERVICE. 1921.
Oct. & Dec. Vol. 1. Nos. 4 & 6. pp. 132 & 194.

Two interesting pieces of propaganda are extracted.

“ WHO AM I ?

“ I am more powerful than the combined armies of the world ;
“ I am more deadly than bullets, and I have wrecked more homes
than the mightiest of siege guns ;
“ I steal in the Philippine Islands alone many millions of pesos
each year ;
“ I spare no one, and find my victims among the rich and poor alike,
the old and young, the strong and the weak ;
“ I massacre thousands and thousands of wage-earners each year ;
“ I lurk in unseen places and do most of my work silently. You
are warned against me, but you heed not ;
“ I am relentless ; I am everywhere : in the home, on the street,
in the factory, at the railroad crossing, and on the sea ;
“ I destroy, crush and maim ; I give nothing and take all ;
“ I am your worst enemy ;
“ I AM CARELESSNESS.
“ But one thing can conquer me !

“ HEALTH EDUCATION.”

“ IMPORTANCE OF BIRTH REGISTRATION.

“ In our Decalogue on Health (*Monthly Bulletin* for September, 1921) we placed as the first requisite :—

- “ 1. Insist on prompt and complete birth registration—
 - “ (a) To prove the age.
 - “ (b) To show the citizenship.
 - “ (c) To prove the right to vote and to be elected.
 - “ (d) To apply for an employment.
 - “ (e) To prove the right to an inheritance.
 - “ (f) To get married.
 - “ (g) To obtain passports.
 - “ (h) To prove the legitimacy or illegitimacy of a person.
 - “ (i) To enter in a college or university and obtain any degree thereof.
 - “ (j) To comply with the requirements in any court.”

UNITED PROVINCES. Public Health Department. i. Smallpox.
ii. Cholera. iii. Plague. iv. Malaria. v. Flies. [SOUSA (A.),
Director of Epidemiology.—11 pp.; 11 pp.; 12 pp.; 12 pp.;
11 pp. Illustrated.

We have received five small pamphlets on smallpox, cholera, plague, malaria, and flies, intended for the health propaganda work in Indian villages. They are extremely well got up and very useful. A sample page of one of these little books is given. (Fig. 101.)

CHOLERA.

**FIGURE
6**



**FIGURE
7**



Doctor: "Now I will tell you how the disease came to your village. This Kanaya Lal brought the disease with him. He ate sweets which were exposed to flies. Those flies had been previously sitting on the stools and vomited matter of the cholera patients and thus infected the sweets. Kanya Lal should not have taken a bath at the well on his arrival. By doing so, he did harm to others. This well has no parapet wall and consequently the cholera microbes which were on Kanaya Lal's body were washed into the well when he took a bath. Your wife brought the water from that well and gave to your sons and the cholera microbes got into their bodies.

(Fig. 7.)

FIG. 101.—UNITED PROVINCES. Reproduction of a specimen page from Dr. A. Sousa's pamphlet on Cholera.

The pamphlets are practically all pictures, with a small amount of legend in dialogue form. Those requiring literature for propaganda work in any country inhabited by a primitive community could not do better than purchase copies of these pamphlets for distribution, particularly if translated into the language of the country.

A SAÚDE PÚBLICA. (Rio de Janeiro.) 1922. Jan. Vol. 1. No. 1. pp. 1-2. **A Peste.** With 1 fig.; p. 2. **Tuberculose.** With 1 fig.; No. 2. p. 3. **Da febre typhoide.** With 1 fig.

In another portion of this Supplement we have mentioned that the Government of Brazil are undertaking some drastic sanitary improvements. Here are two numbers of a little newspaper called "The Public Health," entirely devoted to the subject of propaganda.

We give from this three small diagrams (figs. 102-104) which are evidently used to explain the way in which certain diseases are disseminated. It is unnecessary for us to say more; the pictures are self-explanatory.

FIG. 102—Plague.

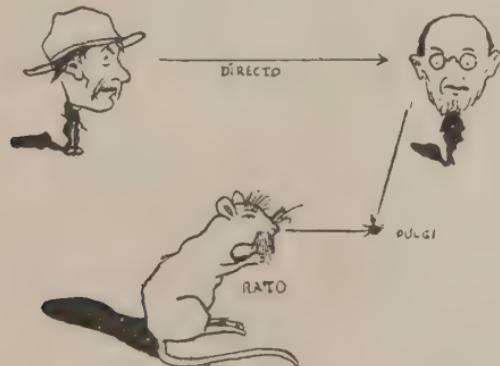


FIG. 103.—Tuberculosis.

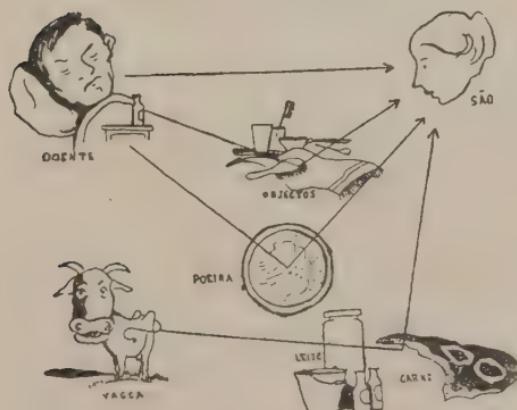
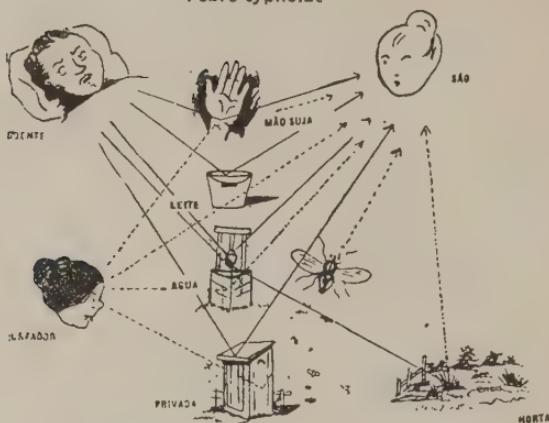


FIG. 104.

Febre typhoide



Figs. 102-104.—Three diagrams explaining to the Brazilian public the modes of dissemination of plague, tuberculosis and typhoid fever.

[Reproduced from *A Saúde Pública*, Rio de Janeiro.]

CONSERVANCY.

WAR DEPARTMENT. The W.D. Drainage Manual. Third Edition.

Revised to 1921.—78 pp. With 21 plates & 35 text figs. 1921.

London : Published by H.M. Stationery Office. [Price 5s. net.]

All sanitary engineers throughout the tropics should obtain copies of this book. It is to be purchased through any bookseller or directly from H.M. Stationery Office, Imperial House, Kingsway, London, price 5s.

The book deals with everything in connexion with drainage and household sanitation. It deals with water closets, latrines, urinals, sinks, ventilation of drains, flushing of drains, materials to be used in drainage, man-holes, flush tanks, gulleys, etc. Such subjects as sewage farms, aerobic filters, activated sludge process, sewage, etc., are also dealt with at length.

BOLTON (Joshua). Aeration Experiments at Bury.—*Surveyor.* 1922.

May 26 & June 2. Vol. 61. Nos. 1,584 & 1,585. p. 417, pp. 435-436.

The author commences this paper with an interesting survey of the history of activated sludge; he goes on to say that he does not consider that the activated sludge process is suitable for crude sewage containing strong doses of trade wastes, without preliminary sedimentation.

" My experience had led me firmly to the conclusion that for a sewage containing trade waste it will be absolutely necessary to have preliminary settling and equalizing tanks, so as to effectively equalize, and in a great many cases neutralize, the inhibitory substances which come down the sewers in rushes."

The author, therefore, allows a nine-hour settlement for the crude sewage, but then describes a particular form of tank which he has devised.

" The tank is 24 ft. diameter, provided with a coned bottom, the depth to the bottom of the cone being 18 ft. An inner division is constructed of light timber, 19 ft. diameter, and carried 10 ft. 6 in. below top water level. This shell divides the tank into two compartments, the inner, which has a capacity of 32,700 gals., acting as the aérating chamber, and the outer chamber, which has a capacity of 11,300 gals., acting as a settling chamber. The centre chamber is fitted with a cone provided with suitable vanes and an opening at the bottom. From the bottom of the cone a trunk 3 ft. in diameter is led to within 6 in. of the bottom of the tank. When the cone is set in motion the liquid is thrown off at the periphery and the mixture of sludge and liquid rushes up the centre trunk to replace that displaced by the cone. As the liquid is thrown off from the cone it is brought into contact with the atmosphere, and as it strikes the surface of the main body of liquid in the tank a large number of air bubbles are carried down into the liquid, and by this means sufficient oxygen is taken up by the sludge to keep it in an active condition and bring about the required purification."

The author then goes on to say that the value of the activated sludge method centres on the economic factors.

"That sewage can be purified by this method is assured, but its advantages over the percolating system simply resolves itself into this : Will the saving on interest and sinking fund by the less costly construction of aération tanks against percolating beds more than balance the cost of power ? "

"The following are the average results of analyses.

Oxygen absorbed.	Settled sewage.	Effluent.	Purifications.
3 mins. ..	1.34	0.30	77.6 per cent.
4 hours ..	3.98	0.71	82.2 per cent.
Ammonias—			
Free and saline ..	2.10	1.60	23.8 per cent.
Albuminoid ..	0.52	0.09	82.7 per cent.
Chlorine	6.20	6.10	—
Solids in suspension ..	3.20	Traces	—
Nitrates	—	—	—
Dissolved oxygen taken up in 5 days	—	0.63	—

All quantities stated in grains per gallon."

The chemical analyses show that the results were distinctly favourable in Bury. The writer, however, does not state what he does with the sludge from the sedimentation tank and how much of this he obtains in a year.

There is no doubt whatever that the activated sludge process will deal with a reasonably concentrated domestic sewage without lengthy sedimentation. It may, however, be very desirable, as pointed out by the author, to have a tank of considerable capacity to equalize the rushes of chemical material discharged into the sewers in manufacturing districts.

THE SURVEYOR & MUNICIPAL & COUNTY ENGINEER. 1922. Aug. 4.
Vol. 62. No. 1,594. p. 76.—Development in Activated Sludge Process. Details of New Method.

The following extract is taken from a recent article on activated sludge plants. It will be remembered that in this method of disposal the sewage is stirred up by means of compressed air with the "activated sludge." It is also known that in modifications of this method paddle wheels and other mechanical devices are used instead of compressed air and have given satisfactory results [see Sanitation Supplements, 1921, p. 193].

These appliances all require considerable power.

"The new method is based upon the simple idea of making the sewage which is being treated become its own conveyor of energy. The tank in which the bacterial purification of the sewage takes place is constructed in the form of a long channel of comparatively small cross section, through which the combined sewage and activated sludge is made to pass at a velocity sufficient to prevent the sludge settling at the bottom. The channel is so formed that the sewage at the end of its passage though it is brought close to the spot from which that passage originated, but at a slightly lower level, this difference of level representing the fall required to maintain the velocity in the channel,

" The sewage is lifted from the lower to the higher level by a pump or other mechanical means designed for lifting a large volume to a very small height. In this way sufficient head is put on the sewage in the channel to ensure that it not only flows along the latter at the desired velocity, but also has imparted to it the additional energy required to overcome the resistance caused by the various operations for stirring it during its whole course along the channel. The stirring is produced by introducing certain modifications in the section of the channel at such intervals that the subnatant sewage is continually being brought to the surface and thus exposed to the action of the atmosphere throughout its passage. The stirring appliances are so designed as to produce the desired movement in the liquid but to avoid all useless movements and eddies; thus the great loss of power which would result if this precaution were not taken is avoided."

The new method is based on the assumption, with which we do not by any means agree, that the air is entirely mechanical in action. It will, however, be interesting to see how this method works in practice.

EATON (Robert). **Application of Liquid Sludge to Farm Land.—Surveyor.** 1922. Vol. 61. No. 1588. p. 487.

The Samlesbury Estate of the Blackburn Corporation was used in the old days for broad irrigation of sewage; subsequently contact beds and septic tanks were added.

During August, 1909, experiments were commenced to ascertain whether the sludge produced by the septic tanks could be disposed of on the old sewage farm. The results have been most encouraging: the area absorbed large quantities of sludge, the available area of the farm, chiefly grass, being about 500 acres. No plot was sludged more than once a year.

The crops are heavy and satisfactory. Occasionally during wet weather, and just before the hay harvest, sludge is washed into the streams, but to avoid this a small area is reserved for summer sludge. A summary of the results is given below.

" (1) The method is cheap and effective.

" (2) Will deal with activated sludge just as easily as with the different tank, septic or humus sludges.

" (3) The sludge with its manurial value is returned direct to the land at one operation, which after 13 years shows no sign of ill effects from such treatment.

" (4) There are no complications arising from the use of machinery.

" Last year, 1921-22, 36,000 tons of wet sludge were irrigated over the farm land, or roughly 100 tons per day. Now 300 acres are more than equal to deal with this quantity, but much of the estate is not suitable for the direct application of sludge, so that an additional 60 acres have been lately acquired, making the total of 570 acres.

" Thirty-six thousand tons on 300 acres correspond to 120 tons per acre, and equal 26,880 gals. per acre, which is a little over 1 in. over the surface. One inch of rain equals 22,620 gals. per acre.

" Our population is estimated at 133,000, and the labour charges, 1921-22, for sludging and repairs to drains were £546 and £224 respectively, total £770.

"The inclusive labour costs for sludging per ton of wet sludge works out at 5·13d."

"The inclusive sludging costs per annum per head of the population were 1·4d."

RICHARDS (E. Hannaford) & SAWYER (G. C.). **Further Experiments with Activated Sludge.**—*Jl. Soc. Chem. Industry.* 1922. Mar. 15. Vol. 41. No. 5. pp. 62 T.-70 T. [Discussion, pp. 70 T.-72 T.]

This paper is a highly technical and interesting piece of work on the constitution of activated sludge. We do not consider that it need be reviewed in great detail, because the subject is not one of much practical importance to many sanitary officers in the tropics.

We, however, give the conclusions arrived at by the writers in their own words.

"The present communication deals more particularly with attempts to answer the following questions :—

"(1) Does the activated sludge process recover more of the nitrogen in sewage than the older methods of sewage purification ?

"(2) Is the nitrogen recovered in the sludge in a form available as plant food ?

"(3) What is the source of the high nitrogen content of activated sludge ?"

Summary of laboratory experiments :—

"1. If activated sludge is aerated for a short period in an ammoniacal solution the recovery of nitrogen is quantitative. The nitrogen not found as ammonia or nitrate in the effluent is recovered in the sludge.

"2. If aeration is continued loss of nitrogen occurs. The loss is roughly inversely proportional to the volume of sludge present.

"3. The same effects are observed with sewage. The ammonia falls while the sludge gains nitrogen with a loss of nitrogen on the whole balance after 16 days operation.

"4. There is considerable evidence that the extra nitrogen in activated sludge, over and above that found in the old type sludges, is derived from the ammonia of sewage. There is no evidence of fixation of atmospheric nitrogen.

"5. The numbers of protozoa in well-activated sludge approximate to 1,000,000 per gram of wet sludge. The cell content of these organisms alone may account for a large proportion of the extra nitrogen.

"6. There is complete correlation between the numbers of active protozoa and bacteria in activated sludge under varied conditions of working.

"7. The increase in bacterial numbers following suppression of the protozoa produces no improvement in purification of sewage. There is, however, a change in bacterial flora, nitrifying organisms being suppressed by the partial sterilization. When nitrifying organisms were reintroduced a greater quantity of nitrate was found in the partially sterilized than in the untreated sewage. Our experiments do not enable us to decide whether this results from a large production or a decreased destruction of nitrate."

Summary of results of tank experiments :—

" 1. Activated sludge produced at Harpenden from a domestic sewage of rather above average strength, with a small proportion of detritus, contains from 5·5 to 6·8 per cent. of nitrogen calculated on the dried sludge.

" 2. Very great variations in the method of working, e.g., in the volume of air, strength of sewage, amount of sludge in tank and time of retention produce no appreciable change in the nitrogen content of the sludge.

" 3. Observations made in working the experimental tank confirm the laboratory experiments designed to find the source of the extra nitrogen content of activated sludge compared with ordinary sewage sludges. They afford no evidence of fixation of atmospheric nitrogen, but suggest that in addition to colloidal nitrogen, ammonia is removed from the sewage by physical or biological means, or both.

" 4. Under strongly aerobic conditions and with a small proportion of sludge in the tank (less than 25 per cent.), the recovery of sludge is practically quantitative (colloids neglected), i.e., its weight is practically the same as the weight of the suspended solids in the sewage. If aeration is moderate to poor, and if the volume of sludge is allowed to accumulate up to 50 per cent. or more, over half the dry matter in the suspended solids of the sewage disappears.

" 5. Variation of conditions (as in 4 above) influences the nitrogen changes in a similar way, but there is always a *loss* of nitrogen—under favourable conditions 20 per cent., under unfavourable 80 per cent., of the nitrogen left in the tank is not recovered.

" 6. The proportion of total nitrogen in the Harpenden sewage recovered in normal working by the activated sludge process is greater than in the older methods of sewage purification, viz., 15 per cent., compared with 10 per cent. by precipitation and 4 per cent. by septic tanks. With sewage of half the average strength and supplying twice the normal volume of air per gallon of sewage, the recovery of nitrogen was as high as 27 per cent. of the total nitrogen in the sewage."

CLEMESHA (W. W.). The Collection and Disposal of Excreta in a Small Tropical Village. [Paper read before the Thirty-third Congress

of the Royal Sanitary Institute, Bournemouth, July 24 to 29, 1922.]

This paper is an attempt to answer the query : Can anything of value be done for the sanitation of small agricultural villages in hot countries ?

The author considers that for small villages with a rainfall less than 30 or 40 in., and a low subsoil water level, the "pit latrine" is the most satisfactory under all circumstances. He recommends a "well privy" for the single family and the deep trench type with multiple seats for the public latrine. In villages where a fair quantity of combustible material is available (particularly villages situated in the jungle and in the bush) a very simple form of incineration works is satisfactory provided a local attendant is taught how to manipulate it. In villages in hilly countries where there are plenty of streams, or those situated on banks of rivers, a simple form of septic tank latrine may be installed with great advantage; although these arrangements require little or no attention, they are obviously more costly than either of the other two suggested methods.

THE SURVEYOR & MUNICIPAL & COUNTY ENGINEER. 1922. Aug. 4.
Vol. 62. No. 1594. p. 84.—**Nuisance from Refuse Tips.**
Precautions recommended by Health Ministry.

“ The list of suggested precautions is as follows :—

“ 1. Every person who forms a deposit of filth, dust, ashes or rubbish, of such a nature as is likely to give rise to nuisance, exceeding *cu. yds., must, in addition to the observance of any other requirements which are applicable, comply with the following rules :—

“ (1) The deposit to be made in layers.

“ (2) No layer to exceed †ft. in depth.

“ (3) Each layer to be covered, on all surfaces exposed to the air, with at least 9 in. of earth or other suitable substance ; provided that during the formation of any layer not more than *sq. yds. may be left uncovered at any one time.

“ (4) No refuse to be left uncovered for more than 72 hours from the time of deposit.‡

“ (5) Sufficient screens or other suitable apparatus to be provided, where necessary, to prevent any paper or other debris from being blown by the wind away from the place of deposit.

“ 2. Every person who deposits any filth, dust, ashes or rubbish likely to cause a nuisance if deposited in any water must, so far as practicable, avoid its being deposited in water.

“ 3. Every person who deposits any filth, dust, ashes or rubbish must take all reasonable precautions to prevent the breaking out of fires and the breeding of flies and vermin on or in such deposit.

“ 4. If the material deposited at any one time consists entirely or mainly of fish, animal or other organic refuse, the person making such deposit must forthwith cover it with earth or other equally suitable substance at least 2 ft. in depth.

“ 5. Every person who deposits any filth, dust, ashes or rubbish must take all practicable steps to secure that tins or other vessels or loose debris likely to give rise to nuisance are not deposited in an exposed condition on or about the place of deposit.

“ 6. Sufficient and competent labour must be provided in connection with the deposit to enable the necessary measures to be taken for the prevention of nuisance.

“ 7. So far as practicable each layer of refuse which has been laid and covered with soil must be allowed to settle before the next layer is added.

“ 8. Wherever practicable the person making the deposit must avoid raising the surface of the tip above the general level of the adjoining ground.

“ 9. All refuse must be disposed of with such dispatch and be so protected during transit as to avoid risk of nuisance.”

* Appropriate figures should be inserted here, after full consideration of the local conditions. The Ministry will be glad to advise on this point, and, in any event, to be informed of the figures adopted.

† Unless the circumstances are very exceptional, the depth of the layer should not exceed 6 ft.

‡ The object of this is to provide that even the surface which is allowed to remain exposed under the proviso to (3) shall be covered up after 72 hours.

WATER.

MAURITIUS. Report on Questions of Water Supply and Sewerage of Port Louis and the Plaines Wilhems Towns. [By James MANSERGH & Sons, MM.Inst.C.E., MM.Assoc.Cons.E.]—77 pp. 1922. Waterlow & Sons, Ltd., London Wall, London.

Whilst reports of the sanitary conditions of a town or country by a sanitarian or medical man are extremely common, it is comparatively seldom that we get for review similar reports written by first-class engineers.

The report by Messrs. James Mansergh & Sons, of Victoria Street, is complementary to the series of reports we have already reviewed, written by Dr. A. BALFOUR.

Sanitary engineers all over the tropics would be greatly interested in this work and should certainly obtain copies. It will obviously appeal more to the sanitary engineer than it does to the medical officer.

The report is divided into two parts, namely (i) the improvement of the water supply of Port Louis, and (ii) the remedying of the defects in the existing system of drainage. It is suggested that a chlorination plant should be put in at once to purify the Grand River water, as it will be some time before the new supply from the Mare-aux-Vacoas can be brought into the town. The engineers then give the details of the proposed new supply. The cost of the new scheme will be nearly five lakhs of rupees.

Concerning the sewage work it is intended to put in properly constructed water-flushed latrines, to extend and improve the existing system of sewers, and to construct a proper outfall works. Messrs. Mansergh consider that as disposal works the two-storied septic tanks is the best method of treatment. In a colony like Mauritius, which depends largely on the cultivation of sugar cane, it seems a pity that the manurial value of the sewage cannot be placed at the disposal of the cultivator by the installation of the activated sludge process. There is, however, a great deal to be said for the engineers' point of view, that this process requires power and a certain amount of skilled attention which is not always forthcoming in the tropics.

RACE (Joseph). Chlorination of Municipal Water Supplies.—*Jl. State Med.* 1922. June. Vol. 30. No. 6. pp. 263–266.

Chlorination of water in America, it would appear, is very much more used than in England. At present there are 4,000,000,000 gals. of water chlorinated daily in America in a total number of installations of 2,500. In England and Europe generally the use of chlorine as a purifying agent is not so great, because filtering plants are commoner.

The article describes the use of the three forms of chlorine : (1) Hypochlorite, such as bleach ; (2) a gaseous form of chlorine ; (3) chloramine. As regards the two former, the technique is pretty well known.

Concerning chloramine the writer points out that it can only be successfully used in large works under expert supervision. The dosage depends on a number of factors, the most important of which are the purification desired, the amount of oxidizable matter present in the water, the contact period, the temperature of the water and the method of admixture.

One interesting point in the use of chloramine is as follows. With the use of bleach and liquid chlorine what are known as "after growths" were occasionally found; ("after growths" of bacteria may be described as a rapid multiplication of one variety due to the upset of the bionomic balance owing to the use of chlorine. The multiplication usually takes place in the service reservoirs and in the mains). When chloramine is used no "after growths" occur. Chloramine apparently works best in water of very low temperature. If it is to be a success it must be mixed quickly and evenly throughout the water.

The writer points out that the use of chlorine is the cheapest method of purifying large quantities of water. He does not, however, suggest that it should replace filters, but that in places where filters exist if the bacteria are killed by chlorine the existing filters might be used at double or treble their usual speed, in this way increasing the economy of the plant considerably.

It is, of course, well known that during the war much of the London water was chlorinated in order to save money.

THE SURVEYOR & MUNICIPAL & COUNTY ENGINEER. 1922. June 16.
Vol. 61. No. 1587. p. 472.—**Water Purification. Chlorination
Tastes and Odours.**

The "Canadian Engineer" discusses how the tastes and odours arise in chlorinated water. It is probably due to chloro-phenols, but this is not certain.

In New York it was found that tastes and odours were overcome by increasing the dose of chlorine, as advocated by HOUSTON in England. In New York, where taste occurred following the presence of algae, the chlorine dose was raised from 0.3 to 0.7 parts and the taste then practically disappeared.

MINETT (E. P.). **A Cheap Form of Artesian Water Supply for Villages in the Tropics.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1922. Feb. 16. Vol. 15. No. 8. pp. 259–263. With 4 figs. & 3 plans.

We publish three pictures of a simple apparatus for removing iron, which has been used by Dr. Minett in British Guiana. The source of water supply is from an artesian well, 500 to 600 ft. deep; it contains a considerable quantity of ferrous iron.

The particular well has given about 250,000 gals. per day during the last six years. The water contains 0.56 parts per 100,000 of iron. After aeration and filtering this is entirely removed.



FIG. 105.—Showing perforated casing to well at water exit with trays to spread out water and assist aeration. Top of tray with baffle boards and large stones shown.



FIG. 106.—Spray, etc.—Showing double roof of storage tank beyond. [Reproduced by permission from the Transactions of the Royal Society of Tropical Medicine and Hygiene.]

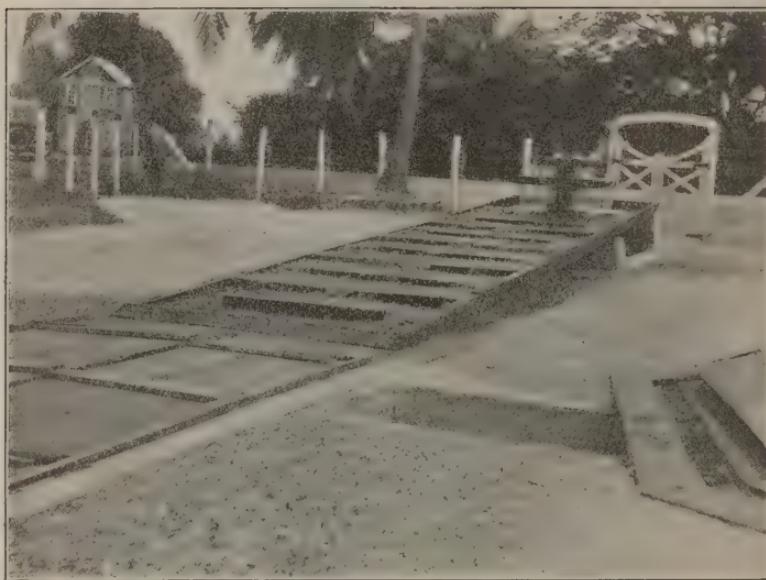


FIG. 107.—View of spray and inclined plane shoot with baffle boards and large stones to collect deposited iron. Filter shown with wood covering closed.

[Reproduced by permission from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*.]

WHIPPLE (Melville C.). **Review of the Director of Water Examination's Fifteenth Annual Report** (entitled *Fifteen Years of Investigations by the Laboratories of the Metropolitan Water Board*, and appearing in the *Journal of the American Waterworks Association*, Vol. 9. No. 2, March, 1922).—*Sixteenth Ann. Rep. of the Metropolitan Water Board, for the Twelve Months ended 31st March, 1922*. pp. 53–61. London: P. S. King & Son, Ltd., 2 & 4, Great Smith Street, Westminster.

"The principal sources of London water are three rivers—the Thames, the Lee, and the New, all of which are polluted and require purification by storage, filtration, chlorination, or a combination of these processes. Control of raw sources, operation of purification works, and proper regard for the physical, chemical, and bacteriological quality of the water delivered to consumers all demand laboratory facilities, and in the case of a system as large as that of London they involve a large amount of analytical work. It is now sixteen years since the laboratories of the Metropolitan Water Board were established to take care of such demands, and at their head, as Director of Water Examination, has been a man widely and favourably known in the United States, Sir Alexander Houston.

"The routine of these laboratories involves annually an examination of nearly 13,000 samples, a large task in itself, and one which has been an important factor in the maintenance of a typhoid fever rate of 1·7 per 100,000 in the years before the war. In addition, a large amount of research has been conducted upon problems having to do with the quality and purification of water and technical procedures in the laboratory. Much of this has been fundamental in character and the results have been

used the world over to advance the art of water purification and our understanding of quality changes. These contributions rate the London laboratories among the foremost in general usefulness to all men engaged in water purification problems.

" Ready access to all this work has been made possible through a liberal policy of publication. A series of monthly reports since November, 1905, has formed a part of the Government Water Examiner's Monthly Report on the Metropolitan Water Supply, and these have been followed since March 31, 1907, by fifteen Annual Reports on the quality of London waters and thirteen Reports on Research Work, both compiled by Sir Alexander Houston. The Annual and Research Reports have been exhaustive and complete in the presentation of data. The discussions and conclusions have been admirably presented in a logical and forceful manner. In fact, these reports occupy a place in waterworks literature unique in themselves, and for this reason have always been awaited with interest and admiration on the part of those who were fortunate enough to receive them.

" It has always been a matter of regret to the writer that much of the best work done by American waterworks laboratories has been made useless to all but a very few through a lack of proper publication. Some of it has never been published owing to perverted policies of economy in printing, some has been presented in a fragmentary way through the medium of short professional papers, and a great deal has been presented in a weak and 'dry' manner. Our larger laboratories would do well to adopt some method of issuing at least occasional reports of research or routine work which merits the use of imagination and a convincing manner of presentment.

" In his Fifteenth Annual Report for the year ending March 31, 1921, Sir Alexander has taken occasion to review some of the investigations carried out under his direction, touching the high lights of achievements in the fifteen-year period. It is perhaps worth while to recall in brief fashion the results of the more important studies."

VITALITY OF TYPHOID BACILLUS IN WATER.

" In the First, Sixth, Seventh, and Tenth Research Reports experiments are described bearing on the vitality of *B. typhosus* in water. The findings are now classic and are quoted wherever the subject comes under discussion. The first studies were made upon cultivated strains of laboratory cultures. These were inoculated into river water and the number of surviving organisms determined from time to time. Over 99 per cent. of the original number, whether large or small, succumbed in the first week. A few survived for five to eight weeks, forming the group often spoken of now as the 'resistant minority.' Their significance has been a subject for much discussion, but general opinion supports the conclusion that four weeks' storage provides a reasonable margin of safety. These investigations were undertaken with special reference to the storage of polluted waters, which is widely practised in England.

" Later experiments were made with uncultivated typhoid bacilli taken directly from their parasitic existence and introduced into water, just as they are under natural conditions of spreading infection. These died much more quickly than the laboratory strains, and this was the case in both laboratory and outdoor experiments in tanks holding 350 gallons of river water.

" A most important phase of these studies was the effect of temperature. At 50° F., and above, the initial rapid drop in numbers took place in the first week as noted, but, at 41°, one to two weeks were required and near

the freezing point from two to three weeks. Assuming that a reduction from 100,000 typhoid bacilli per cubic centimeter to 3 per cubic centimeter represents practical sterility, Sir Alexander concluded that this result can be reached by

- 5 weeks' storage at 32·0° F.
- 4 weeks' storage at 41·0° F.
- 3 weeks' storage at 50·0° F.
- 2 weeks' storage at 64·4° F.

" All of this work brought out clearly the great purifying influence of adequate storage upon contaminated waters; it also demonstrated the fortunate fact that the greatest natural protection is afforded during and immediately preceding those months when the incidence of typhoid fever is highest, namely, during the late summer and fall. On the other hand, it emphasized the added significance of the presence of infective material in water during the cold months of the year when destructive influences are less marked and when sudden increases in flow tend to shorten the period of travel from watersheds through reservoirs, and to the consumer."

THE CHOLERA VIBRIO AND TESTS FOR ITS IDENTIFICATION.

" Cholera may be a water-borne disease, although it has given in recent times little cause for worry in northern temperate countries, largely through the vigilance of health authorities who have prevented its becoming endemic by control measures at ports of entry. Nevertheless, there is a possibility that this protection may not always be maintained, and for this reason the work dealt with in the Fourth, Fifth, Eleventh, and Twelfth Research Reports on the cholera vibrio in river waters represents a reserve of scientific knowledge which may be drawn upon in any emergency. Already it must have found application in warmer countries where cholera is endemic.

" As in the case of the typhoid bacillus, storage of infected water was found to accomplish a rapid and great reduction in the number of cholera vibrios, 99·9 per cent. after one week. After three weeks the cholera vibrio could not be isolated in 100 cc. of water. The protection afforded against this pathogenic organism was, then, equally as great as in the case of *B. typhosus*. The reports of the cholera vibrio experiments show that this microbe can be isolated from raw river water even when present in small numbers. One of its chief characteristics is the production of the cholera-red reaction in peptone broth when sulphuric acid is added to 37° cultures of 24 to 40 hours' growth.

" The immense amount of work done in these laboratories on certain problems is well exemplified by the study of the reliability of the cholera-red reaction in excluding harmless water bacteria. Some 2,400 samples were examined and 6,000 colonies isolated. Only 3 per cent. of these gave a provisional or presumptive test by the cholera-red reaction, and none of them answered the true cholera standard when final confirmatory tests were made. The conclusion was that there is no danger of reporting the cholera vibrio present in non-infected waters if suitable tests are made."

SEARCH FOR SPECIFIC DISEASE ORGANISMS IN RAW WATERS.

" One of the most extensive and laborious pieces of research reported during the fifteen years was that involving the search for specific microbes of water-borne diseases in polluted river waters. Details of the experiments are given in the Second, Fifth, Seventh, Ninth and Tenth Research Reports. The first work, in 1908, involved a study of 7,329 microbes from 156 samples of raw river water. Not one of these proved to be *B. typhosus*.

"A very important fact to be established in this connection was the delicacy of such tests—that is, a knowledge of the smallest amount of water that could be expected to give a positive result in the presence of the organisms. This was done by a system of comparative examinations in which the raw Thames and Lee samples to be examined were divided into two portions, one of which was inoculated with a pure culture of the organism. Both portions were then examined quantitatively. Out of 22,141 sub-cultures from river water not one proved to be *B. typhosus* or *B. enteritidis* (Gärtner's bacillus). Three colonies were classed as doubtful, two of them as *B. typhosus*. By dividing the average number of specific organisms recovered from the whole of the inoculated portions by the average number of specific organisms per cubic centimeter which were originally added, there was obtained an inferential index of the amount of water which might be expected to contain one organism and so give a positive result. Under the conditions of these experiments *B. typhosus*, from this index, could have been detected in the river water, if present, to the extent of 1 in 9 cc., and *B. enteritidis*, 1 in 19 cc.

"Using these figures for the raw water and concluding from results of six years' (1906–1911) treatment of the River Thames water that the 'microbial badness' was reduced 1,000 times before reaching the consumer, as shown by *B. coli* tests, the conclusion of Sir Alexander was that there were good grounds for the assumption that *B. typhosus* was not normally present in tap water in the proportion of 1 per 9,000 cc., nor Gärtner's bacillus in the proportion of 1 per 19,000 cc.

"These and other deductions from a mass of experimental data serve to indicate how facts which seem to possess only scientific interest can be given practical significance in the hands of a competent and careful interpreter."

STUDIES OF STREPTOCOCCI.

"Many water analysts will remember the controversy which was waged some ten years ago in regard to the presence and significance of streptococci in water. Many media were devised for their cultivation, but most of them have fallen into disuse and the presence or absence of streptococci is now seldom sought.

"The Laboratories of the Metropolitan Water Board engaged in long and painstaking research on the subject of the bacterial flora of human and animal feces, on the biological characters of different strains of streptococci which were isolated, and on the presence of streptococci in sewage polluted waters, particularly those of the Thames, Lee and New Rivers. Results of this research are given in the Fifth and Tenth Research Reports and in the Annual Reports of 1908 and 1909. Of passing interest in this connection was the invention of a series of descriptive terms to designate different strains of streptococci. These terms were compounded from cultural attributes of the strains, e.g., 'lamirascal,' denoting acid in lactose, clotting in milk, acid in raffinose, saccharose and salicin media.

"The conclusions reached were that human feces usually contain a very large number of streptococci, more than 100,000 per cubic centimeter, although some stools are practically devoid of these forms, that the river waters mentioned contained on the average less than one streptococcus per cubic centimeter, indicating by this test that 10,000 Imperial gallons of water contained less than 1 pound of human feces, and that the chances of any appreciable number of fecal streptococci reaching the consumer of stored and filtered water were very remote. Thus, the tendency of streptococci to succumb rapidly in natural waters renders their use as an index of sewage contamination of little value except to indicate very recent addition of sewage to such waters. Sir Alexander points out the possibility that some fecal forms may be much more resistant, as we know *B. coli* to be, and that quality must be judged by all factors, physical, chemical, bacteriological, meteorological, and epidemiological. This

necessity of weighing all the evidence and of taking the broadest possible view is stressed throughout all his reports and practised in his writing. A recent example of this was his contribution to the Engineering News-Record, September 22, 1921, on 'B. Welchii, Gastro-Enteritis and Water Supply,' a most able review of the work and divergent opinions on this subject.

STORAGE OF WATER.

"The use of large reservoirs, as the Staines, Chelsea, and Walthamstow, has done much to relieve London of the odium of continued use of impure sources. Storage has improved every quality of the river waters, physical, chemical, and bacteriological, 'so that in a sense it may be said that London derives its supply from large relatively pure artificial lakes.'

"Storage and its attendant changes have, therefore, always commanded a great deal of attention from the Laboratories of the Water Board. Various studies are described in the Third, Fifth, Tenth, and Twelfth Research Reports and also in those dealing with the destruction of pathogenic bacteria, as the First, Fourth, Sixth, and Seventh Reports.

"In view of recent discussions in this country relative to the merits of storage and the advisability of putting faith in stored waters, the conclusions of Sir Alexander Houston on this subject are of considerable interest and are quoted from the Fifteenth Annual Report. They deal with the advantages accruing from storage.

"(1) Storage reduces the number of bacteria of all sorts: the number of bacteria capable of growing on 'agar' at blood heat; the number of bacteria capable of growing in a bile-salt medium at blood heat, chiefly excremental bacteria.

"(2) Storage greatly reduces the number of *B. coli*. (Tables of results are given.)

"(3) Storage, if sufficiently prolonged, devitalises the microbes of water-borne disease (*e.g.*, the typhoid bacillus and the cholera vibrio).

"(4) Storage reduces the amount of suspended matter, colour, ammoniacal nitrogen, and oxygen absorbed from permanganate.

"(5) Storage usually reduces the hardness and may reduce (or alter the quality of) the albuminoid nitrogen.

"(6) Storage alters certain chemical river water ratios; for example, the colour results improve more than the results yielded by the permanaganate test.

"(7) Storage has a marked 'levelling' effect on the totality of water delivered to the filter beds.

"(8) Storage always lengthens the life of the filters unless any undue development of algal or other growths has occurred. For example, at the Southwark and Vauxhall Works the life of the filter beds has been greatly lengthened, leading to a great saving in labour since Walton Reservoir water was used for filtration purposes. On the other hand, it must be admitted that when growths are super-abundant river water (except during floods) filters better than stored water. Photographs of some of these growths are shown in the writer's Eleventh, Twelfth and Thirteenth Annual, and Twelfth and Thirteenth Research Reports.

"(9) An adequately stored water is to be regarded as a 'safe' water, and the 'safety change' which has occurred in a stored water can be recognised by appropriate tests.

"Some words of explanation are here needed.

"It is shown not only that *B. coli* is usually absent from 10 cc. of the stored water, but that it is not infrequently absent from even 100 cubic centimeters. Further, 100 experiments carried out over a period of ten months showed that the *B. coli* naturally present in the raw water remain, on the average, alive in 10 cc. of the water for a longer period (about 10 days) than would suffice for the elimination of 99 per cent. of any typhoid bacilli, assuming that these were initially present in the raw

water. The disappearance of the more hardy and robust *B. coli* from a stored water thus affords presumptive evidence of the strongest kind that a similar fate would have befallen the typhoid bacillus or the cholera vibrio, had these pathogenic microbes been present in the water.

It is also possible by chemical tests to gauge the probable 'safety' of a stored water. For example, there are certain ratios which are characteristic of a *raw* water and others equally suggestive of the same water after prolonged storage.

" Take the case of the *raw* Lee and *stored* Lee waters as an illustration.

" 52 samples collected from August 7, 1907 to July 27, 1908, yielded the following average ratios when the (A) ammoniacal nitrogen, (B) colour, (C) colour and (D) turbidity results were in each case divided by the albuminoid nitrogen, albuminoid nitrogen, permanganate and albuminoid nitrogen results, respectively.

Free.		Colour.		Colour.		Turbidity.	
Albuminoid. (A)		Albuminoid. (B)		Permanganate. (C)		Albuminoid. (D)	
Raw	Stored	Raw	Stored	Raw	Stored	Raw	Stored
0.690	0.329	5,419	2,129	436	256	231	21

" Storage thus, on the average, more than halved the (A) and (B) ratios, nearly halved the (C) ratio and produced a ten-fold reduction in the (D) ratio ('traces' considered as 0.25).

" These altered ratios consequent on storage depend, of course, on the modifications in the quality of the *raw* river water, and these modifications take time for their development. Inferentially, it would be quite possible from these ratios to gauge the probable 'safety' of a water from the bacteriological point of view, by correlating the time it takes to produce them with the time required for the destruction of pathogenic bacteria in water. The tendency in some quarters is rather to minimize the value of chemical tests in connection with water supply and the substances which pollute water, owing largely to the rapid strides made in bacteriology within recent years. But it is too often forgotten that, apart from the direct value of chemical tests, the only way of gauging the work done by bacteria may be by chemical analysis. Any process, method, or test which reveals an intrinsic modification in the quality of *raw* river water as the result of storage is both of direct and of inferential importance. That chemical analyses can achieve this end is indisputable.

" (10) The use of stored water enables a *constant* check to be maintained on the safety of London's water antecedent to, and irrespective of filtration.

" (11) The use of stored water goes far to neutralise or wipe out the gravity of any charge that a water supply is derived from polluted sources.

" (12) The use of adequately stored water renders any accidental breakdown in the filtering arrangements much less serious than might otherwise be the case.

" The storage of raw river waters has greatly reduced the load put upon filtration works. In 1910 it was calculated that 93.8 per cent. of raw Thames samples showed *B. coli* present in 1 cc., in the case of the raw Lee 95 per cent., and in the raw New River samples 46.9 per cent. Studies of the stored pre-filtration waters showed that if they were all mixed in proportion to the amount used at the various filters about 37 per cent. of all samples would show *B. coli* absent in 10 cc., that is, over one-third of such samples would be one hundred times better on the basis of the *B. coli* test.

Average number of microbes per cubic centimetre (bile-salt agar test).

Raw Waters.	Stored Waters.
River Thames 49·0	Walton .. . 1·6 (96·7 per cent. reduction)
River Lee .. 38·0	Lee (East London Aqueduct) .. 1·5 (96·1 per cent. reduction)
New River .. 7·7	West Middlesex (1) 4·7 (90·4 per cent. reduction) West Middlesex (3) 4·1 (91·6 per cent. reduction) West Middlesex (4) 5·1 (89·6 per cent. reduction) West Middlesex (6) 3·5 (92·9 per cent. reduction) Lambeth (Island Barn) .. . 3·9 (92·0 per cent. reduction)
	Sunbury .. . 6·3 (87·1 per cent. reduction) New River (Clerkenwell) .. 4·0 (48·1 per cent. reduction)
	New River (Hornsey) .. 3·6 (53·2 per cent. reduction)
	New River (Stoke Newington) 2·4 (68·8 per cent. reduction)
	Grand Junction (Hampton) .. 2·4 (95·1 per cent. reduction)
	Grand Junction (Kew) .. . 5·2 (89·4 per cent. reduction)
	Chelsea .. . 3·0 (93·9 per cent. reduction)

"The above table serves to indicate the reduction in excremental forms of bacteria, as determined by the bile-salt agar test at 37° C.

"Circulation of water in storage reservoirs is discussed in the Twelfth Research Report. Several series of experiments were made with a view to determining the possibility of short circuiting in a reservoir where the position of inlet and outlet were favourable to this effect. The studies and conclusions of this work together with diagrams are a part of the résumé of the Fifteenth Annual Report."

SLOW AND RAPID SAND FILTRATION.

"Rapid sand filters have never met with general favor in England, probably because of the very excellent results achieved over a long period by the old slow sand filters, and also because of a fear that rapid filtration would prove more expensive and would bring about a situation, so far as water quality is concerned, which might prove to be epidemiologically unsafe. The London Water Board, however, has experimented with rapid filters since 1910 in both a small and a large way. Sir Alexander Houston has reported this work in the Thirteenth Annual and Thirteenth Research Reports together with very interesting deductions as to the practicability and advisability of using rapid filtration, either alone with or without coagulant, or as an adjunct to slow sand filtration. He has maintained an open mind on the subject, but it is evident from his writings that there is a strong sentiment in England which clings tenaciously to slow sand filtration, and that alone.

"The successful use of chlorination has tended to weaken this sentiment, largely because it has shown new possibilities for rapid filtration as well as for the older form. Obviously costs as well as standards of safety have to be given careful consideration in any process of purification and these have been outside the main work of the London Laboratories. It may be of interest, however, to note that the cost of slow sand purification as practised by the London Water Board is stated as 28 shillings per million Imp. gallons, of which 8 shillings is for operation and 20 shillings for

capital charges. At normal exchange rates 28 shillings is the equivalent of \$6.80. There seems to be some doubt that this cost can be met by rapid filtration if coagulant is used, unless rates of filtration are employed which imperil high standards of quality. It is admitted that the rapid mechanical filters would possess an economic advantage if coagulant was not used and very high rates were maintained, chlorination being employed to maintain bacteriological quality. Under such conditions, however, experiments indicated that there would be a marked falling off in the physical quality of the water as compared with the effluent of the slow sand process. Color would be increased somewhat and the colloidal suspended matter would be present in a sufficient amount to impart a dull look, destroying the 'clean, polished' appearance of slow sand affluents. Brilliance is recognized as one of the important physical properties of good drinking water, and Sir Alexander is of the same opinion as some of our American authorities that these physical properties must be preserved to meet the demands of the consumer.

"The London Board has authorized the construction of rapid filters at Barn Elms and further experimental work at Staines with a view to their use as primary or prefilters. It is probable that future works will make use of this principle, thus utilizing both the slow and rapid processes of filtration and increasing considerably the existing rates of slow sand filters, which vary between 1,000,000 and 3,000,000 United States gallons per acre per day.

"It is interesting to note that experimental filters of the rapid type, operating without coagulant and at rates of 125,000,000 to 250,000,000 United States gallons per acre per day, successfully removed over 80 per cent. of the bacteria and nearly all 'plankton' forms. The reduction in color was not as great as is obtained with slow sand filters, and there was not as complete removal of colloidal material. Effluent waters had the dull appearance noted above, a characteristic often noted in natural waters having some colour and practically no turbidity."

EXCESS LIME AS A DISINFECTANT.

"Many who read this article will remember the experiments carried out at Columbus, Ohio, about 1912, which demonstrated the disinfecting power of caustic lime toward *B. coli* and fecal forms of bacteria. A marked reduction in the number of the organisms occurred if enough lime was added to neutralize the free CO_2 , to precipitate the bicarbonates, and to leave an excess of several parts per million of caustic alkalinity. The practice was relied upon in one emergency, March, 1913, to disinfect the city mains after flood water had gained access to them by the washing out of a large main.

"The Columbus work was suggested by the experiments originally carried out by the Laboratories of the Metropolitan Water Board which are described in the Eighth, Ninth, Tenth and Eleventh Research Reports. When this form of disinfection is made a supplementary part of water softening, it can be easily carried out and is fairly effective, for *B. coli* and kindred forms do not survive at hydrogen-ion concentrations which are produced by caustic alkalinity. The process, however, will never supplant the more effective treatment of chlorination, which is also cheaper unless softening is the primary end sought.

"A further sphere of application for this method of treatment, and one which has received but little notice, is that of controlling algae growths. Algae make use of CO_2 for food purposes and when this is exhausted have the power of decomposing bicarbonates. The writer has frequently found the surface water of Massachusetts ponds entirely devoid of free CO_2 and bicarbonates as a result of the growth of microscopic plant forms. If water is artificially softened to the same extent, then one of the most important food elements for algae is removed. The following quotation from the Fifteenth Annual Report indicates that excess lime has a practical field of usefulness in this direction.

"In 1917, Accra was faced with a very unsatisfactory position as regards its water supply. The water (swamp water, liable to pollution) deteriorated to a remarkable extent in the relatively large storage reservoirs, absolutely necessary for purposes of quantity. Exhaustive experiments were made, and it was found that by applying the 'excess lime' method of treatment the water was freed from excremental bacteria (*e.g.*, *B. coli*) and remained clear, odourless, and free from growths under conditions of storage. The saving on alternative purification works represented a large sum of money. This is the first occasion on which the 'excess lime' method has been used for the express double purpose of destroying 'plankton' development and rendering water safe from the epidemiological point of view.

"Other experiments with raw Thames water are reviewed to show the germicidal effect of lime and suggested methods for 'de-liming' or neutralization are given. These include the use of CO₂ from coke ovens, sodium bicarbonate, and the addition of unsoftened water which has been either stored or chlorinated. 'In the use of Thames River Water about 67 per cent. could be limed, and 33 per cent. sterilized by means of hypochlorites, and the whole if mixed would be neutralized, sterilized and softened to the extent of about 16 parts per 100,000 parts (*i.e.*, the hardness of the whole volume would be reduced about 71 per cent.).' The expense of such treatment, in the case of a water as hard as the Thames, could only be justified on the grounds of economic saving through the use of softened water.

"The experience of Aberdeen, which makes use of the soft water of the Dee, is also given. Liming was adopted as one of the three elements in a system of purification, the other two being storage and filtration. Proper disinfection was accomplished within seven days, using 10 parts per million CaO, of which only a small amount was in excess of that necessary for neutralizing CO₂ and bicarbonates.

"In the same chapter various phases and fallacies of water softening as an economic asset are discussed in an interesting way."

STERILIZATION WITH CHLORINE AND HYPOCHLORITES.

"An alkaline solution of sodium hypochlorite containing 10 to 15 per cent. of available chlorine was used in 1905 by Sir Alexander Houston to disinfect the Lincoln water supply. The results of this treatment, together with experiments on effluents of sewage works, are given in the Fifth Report of the Royal Commission on Sewage Disposal, Appendix IV. Further work with waters is described in the Twelfth and Thirteenth Research Reports and in the Eleventh, Twelfth, Thirteenth and Fifteenth Annual Reports of the Water Board. In the latter Sir Alexander takes the opportunity to sum up the advantages and disadvantages of chlorination, and to recall some of the objections on the ground of injury to health which were raised against the use of hypochlorites when he was a pioneer in this field in 1905 and 'had to bear the full brunt of the well meant, but hostile, criticism of his professional brethren.'

"The London laboratories have done a great deal in times past to circumvent the persistence of after tastes and odours in chlorinated waters, taking as a basic principle the belief that the sentiment of consumers on this point, while not based upon injury suffered from the drinking of such waters, is nevertheless something to be respected and not laughed out of court. The latter view has too often been the one adopted in this country, but it is bound to yield as greater recognition is given to the importance of physical qualities. The practice of over-dosing was probably never carried to a more illogical end than it was in many cases with the American Expeditionary Forces in France. The notion that 'if a little is good more is better' too often dominated the practice of water disinfection, particularly in Lyster bags. The result was a water of repugnant taste and odour, which defeated the real objects in view, namely, proper water discipline on the part of the troops and the consumption of adequate

quantities of water. A more moderate dose, such as was applied at water stations having chlorinating apparatus, would have given the protection and would not have sent back to America some two million men with preconceived ideas as to the unfitness of chlorinated water for drinking purposes.

" The work of Sir Alexander Houston with London waters led him to the conclusion that, with the exception of certain special cases where over-dosing is necessary, it was possible to produce a tasteless as well as a disinfected water, using either chloride or lime or liquid chlorine. He considers that the taste of chlorinated water is in the great majority of cases not chlorinous, but that it is the 'iodoform' taste. The latter sometimes results when small but bacteriologically effective doses are used. It may be removed by the addition of potassium permanganate, or by the addition of more chlorine. Experiments recorded in the Thirteenth Research Report indicate that potassium permanganate is effective in removing the 'iodoform' taste from water originally dosed with 1 part in 1,000,000 of chlorine when applied in the proportion of 1 part in 5,000,000 up to 8 parts in 5,000,000, no samples retaining the taste with the larger dose. This is an expensive chemical, judged by market prices, but is one which does not permanently affect the physical quality of the water especially if filtration follows. With a dose as large as 1 part in 1,250,000 a pink tinge persisted for several hours, followed by the brown precipitate of oxide which might require filtration.

" If chlorine was added to remove an 'iodoform' taste already formed or to prevent its forming, a chlorinous taste was likely to develop. This was less unpleasant than the 'iodoform' taste and was capable of removal by dechlorination, using some substance as sulphur dioxide or sodium thiosulphate.

" Waters differed in their ability to produce one or the other taste. In some it was difficult if not impossible to develop the 'iodoform' taste. Without the latter a chlorinous taste did not develop until a residual dose of 0·27 to 0·90 part per million of chlorine remained. The various relations are best indicated by quoting from the Fifteenth Annual Report.

" The following provisional conclusions, subject to any reservations previously made, seem to be justifiable :

" Relation of chlorine to chlorinous taste.

" Huge doses with de-chlorination, *no taste*.

" Doses of about 1 in 1 million (upwards) without de-chlorination, chlorinous taste.

" Relation of chlorine to 'iodoform' taste (when present).

" After de-chlorination, still an 'iodoform' taste.

" After super-dosing with chlorine, *no 'iodoform'* but chlorinous taste.

" After super-dosing with chlorine and de-chlorination, neither an 'iodoform' nor a chlorinous taste.

" Relation of permanganate to taste.

" In small doses, even without sulphite treatment, *no taste*.

" In huge doses, after sulphite treatment, *no permanganate taste*.

" Relation of chlorine, permanganate and filtration to 'iodoform' taste, it being assumed that without the permanganate the 'iodoform' taste occurs.

" First chlorination, then permanganate treatment and lastly filtration, *no 'iodoform' taste*.

" First permanganate treatment, then chlorination and lastly filtration, *no 'iodoform' taste*.

" Chlorination and permanganate treatment simultaneously and then filtration, *no 'iodoform' taste*.

" First chlorination, then filtration and lastly permanganate treatment, no ' iodoform ' taste.

" First filtration, then chlorination and lastly permanganate treatment, no ' iodoform ' taste.

" First filtration, then treatment, and lastly chlorination, permanganate no ' iodoform ' taste.

" First filtration, then chlorination and permanganate treatment, simultaneously, no ' iodoform ' taste.

" First permanganate treatment, then filtration and lastly chlorination, ' iodoform ' taste.

" Successful chlorination of Thames River water at Staines has been practised since 1916, using bleach at a rate of about 0·4 part per million of chlorine. This installation has effected a great saving in pumping costs by making it possible to let the chlorinated water flow down the Staines aqueduct to numerous works below without being pumped to the Staines reservoirs for storage. Water of greater bacteriological purity has been delivered to these works than when stored water was used, and there has been a reduction of something like 20 per cent. in the acreage of filter beds cleaned. The latter is attributed to the mild algacidal action of chlorine and the elimination of growths which develop with storage. At the same time there has been no complaint of tastes due to chlorination. About 2,000,000 people have been served with this water the volume of which amounts to 76,000,000 Imperial gallons daily."

Period.	CHLORINE.					PERMANGANATE.			
	Days.	Water treated.	Chlorine used.	Average dose.	Days.	Water treated.	KMnO ₄ used.	Average dose.	
		mg.*	lbs.			mg.	lbs.	lbs. per mg.	
First..	17	560	1,830	1 in 3·06M	4	132	264	2·00	
Second	12	390·1	891	1 in 4·38M	0	0	0		
Third.	49	1637·6	4,790	1 in 3·42M	9½	317·4	627	1·98	
Total..	78	2587·7	7,511	1 in 3·45M	13½	449·4	891	1·98	

" First period = April 12 to 29, 1920.

" Second period = December 3 to 15, 1920.

" Third period = December 29, 1920, to February 16, 1921.

Average supply per day 33·2 million gallons.
Average dose of chlorine, 1 in 3·43 millions, or 2·9 lbs. per million gallons.

Number of days of permanganate treatment, 13½ or 17·3% of whole.
Cost of chlorine 4d. per lb.
Cost of permanganate 3s. per lb.

	£	s.
Total cost of chlorine	125	3
Total cost of permanganate	133	13

	£	s.
Total cost of chemicals	258	16

Total cost of chemicals per million gallons treated, 2s.

* Imperial gallon used. Equals 1·2 U.S. gallons.

" During a part of the year the water of the New River is treated with liquid chlorine at Highfield on its way to the Hornsey and Stoke Newington reservoirs. A dose of 1 part in 4,000,000 or 5,000,000 is normally added and this is gradually increased, as the turbidity rises in flood time, to about 1 part in 2,000,000. With the maximum dose permanganate is added in the proportion of 2 to 8 pounds per million Imperial gallons in order to prevent tastes. Below, at Wood Green, is a de-chlorinating plant where SO_2 is added at certain times when the chlorine dose is high and the water cold. Daily tests are made to facilitate the control of tastes. The treatment has been very successful, both from the bacteriological standpoint and that of the absence of residual tastes. For example, out of 260 cultures of raw water taken in the cold months at Highfield before chlorination 82·3 per cent. contained *B. coli* in 1 cc. A similar number at Wood Green after treatment showed *B. coli* absent in 96·5 per cent. of 10 cc. portions. The above table is of interest in connection with the operation of this chlorine installation.

" It should be remembered that the object of chlorination of these London waters has not been the attainment of the highest bacterial standard by this treatment alone, but rather an improvement in the quality of waters delivered to existing purification works with a view to relieving the load put upon them and obtaining a final product which will measure up to high standards.

" If space permitted, much more could be written by way of comment and review of the highly interesting and valuable studies which have been carried out by the Laboratories of the Metropolitan Water Board. The preparation of this paper has been an instructive and pleasant task, and the author recommends the various reports for the further perusal of all who are interested in the historical and professional aspects of water purification during the past fifteen years. It is to be regretted that more files of these are not available for study. There is much that is stimulating as well as instructive within their pages."

SMALLPOX VACCINATION.

MADRAS. *Annual Report of the Work of the Vaccine Section of the King Institute of Preventive Medicine, Madras, for the Year 1920-21.* [SYMONS (T. H.), Acting Surg.-Gen. with the Govt. of Madras.]—10 pp. With 2 charts. 1922. Madras : Supt., Govt. Press. [Price Re. 1-4-0.]

This report is interesting because it illustrates the difficulties of introducing improvements in methods in some parts of the tropics.

The whole of the vaccination in Madras, numbering over 2,000,000 cases per annum, was done with lanolinated vaccine; this was introduced by Col. KING and has always been a standard practice for this Province. It has given a remarkable degree of success with an insertion rate of well over 90 per cent. success.

Recently it was decided to make use of the purer but more delicate glycerinated lymph; consequently the manufacture of this article was started and it was issued to the whole Presidency. The success rate dropped to as low as 35 per cent. It was unfortunate that the months of June, July and August were chosen to try this experiment, for it is general knowledge that glycerinated lymph will not stand high temperature for several days.

The general statement that the "vaccine virus is extremely susceptible to increase and variations in temperature" made in this report can only be accepted as correct if the words "if mixed with glycerine" are added. Lanolinated vaccine is not very susceptible to higher temperature, as is shown by the fact that good results have been frequently obtained during smallpox outbreaks in the hottest periods in many parts of India when proper precautions are taken. We are, however, in agreement with the recent decision of the Government of Madras that vaccination should cease throughout the Presidency during the hot weather months. This is the case in all the other Provinces in India and in China.

The obvious conclusion from this incident is that if the glycerinated lymph is to be substituted for a lanolinated the whole method of dispatch and use by the vaccinators must be revised. Many Provinces in India use nothing but glycerinated lymph, notably Burma and Bombay, but special precautionary measures are taken to ensure only active lymph being used. The Directors of the King Institute were apparently not aware of this fact.

Experiments at the King Institute itself show that the glycerinated lymph manufactured by them has given an extremely high rate of point success. This is exactly what one would expect; the difficulty is to get the same quality of results hundreds of miles away from the depot.

JOUVEAU-DUBREUIL. *Le service de la vaccine à l'Institut Pasteur de Tchentou (Setchouen).*—*Bull. Méd. Franco-Chinois.* Pekin. 1920. July-Oct. Vol. 1. No. 1. pp. 4-11. With 2 charts in text.

The writer gives an interesting account of the growth of vaccination in Tchentou (Setchouen). It is remarkable how the history of these vaccination centres repeats itself; always the same worry of opposition from the natives and local doctors, and a hundred other prejudices of

a semi-religious character that have to be overcome ; this takes years of uphill and discouraging work. Finally "European" methods become suddenly popular and from that moment the use of the lymph increases by leaps and bounds.

The method of manufacture is the same in this laboratory as all over the tropics. Buffalo calves have been found to give good results ; as much as 150 to 200 gms. is taken from one animal. A glycerinated lymph is manufactured for use. In the year 1918-19 nearly 100,000 doses were prepared in the laboratory, more than double the quantity of the previous year, so that it would appear that prejudices against modern methods are very rapidly dying out.

As in most parts of the tropics, the natives object to being vaccinated during the summer—they prefer the operation to be performed in the earlier and later part of the winter, particularly September and March.

INDUSTRIAL HYGIENE.

LANZA (A. J.). **Industrial Hygiene with Particular Reference to Conditions in Australia.**—*Med. Jl. Australia.* 1922. June 24. 9th Year. Vol. 1. No. 25. pp. 691-694.

The writer points out the necessity for a proper system of examination into the health of workers in factories in Australia. He lays stress on the importance of occupational diseases, the establishment of minimum standards of factory lighting, heating, dust prevention, etc., as well as the necessity for the proper establishment of sanitary inspection and the regulation of the employment of women and children in industry.

ROBERTSON (D. G.). **The Scope of Industrial Hygiene.**—*Commonwealth of Australia Service Publications.* 1922. No. 20. 44 pp. With 4 plans & 14 illustrations.

This little pamphlet gives an extremely interesting résumé of what may be termed the scope of the various activities of a department of industrial hygiene. One gathers that it is mainly intended for the non-medical public, as it argues at some length in favour of skilled supervision and advice in an industrial concern.

The author goes into considerable detail as to the proper arrangements of first-aid appliances and the ambulance room in connexion with industrial concerns. These seem to us to be a little on the extravagant side, but doubtless they are necessary in Australia, the country for which the brochure was written. The author also urges on manufacturers the necessity for whole-time medical officers in large enterprises and gives an extremely interesting account of what he considers the duties of this officer should be. There is also an important section dealing with the dentist in industry.

REPORTS AND VITAL STATISTICS.

INDIA. Annual Report of the Sanitary Commissioner with the Government of India for 1919, with Appendices and Returns of Sickness and Mortality among European Troops, Indian Troops, and Prisoners in India for the Year. [HUTCHINSON (F. H. G.), San. Comm. with the Govt. of India.]—pp. 156 + 161. With 6 folding charts. 1921. Calcutta : Supt., Govt. Printing, India. [Price not stated.]

Health of European Troops.

Owing to the general upset after the war and on account of the operations in Afghanistan and the North-West Frontiers, many of the troops, particularly British, remained in very hot places during the summer. Out of 56,561 European troops the admission rate to hospital was 972·1 per 1,000, the death-rate 7·74, invaliding 76·4, the average constantly sick 57·39. Invaliding was more than double, undoubtedly due to the war, but the death-rate was low as compared with previous years.

Diseases amongst the Troops.

Malaria still claims a considerable number, namely, 217 admissions and 0·74 deaths per 1,000. This accounts for 22 per cent. of the total admissions to hospital. New Delhi heads the list as being the most malarious place for British troops. Next are Colaba and Bombay, then Rawal Pindi, Peshawar and Lahore. The reason for the state of affairs at Delhi is not far to seek. What is known as the bela is admittedly responsible for the prevalence of the disease. (The bela is a large tract of land which is under water during the rains and covered with vegetation and puddles during the dry weather.)

Enteric Group.—This caused 257 admissions into hospital with 25 deaths, ratios of 4·5 and 0·44 per mille; this is a slight increase on the pre-war figures, but is probably accounted for by the number of troops on active service. These figures include those for paratyphoid A and B as well as typhoid. Forty-seven cases occurred in Poona, 40 of which were attached to the Military Pay Department. These people took their food at restaurants in the city, many of which were distinctly unsatisfactory from a sanitary point of view.

Cholera.—Only 24 admissions, equal to 1·4 per 1,000, with 11 deaths.

Indian Army.

767·5 per mille admissions to hospital, which is a reduction on last year, but still very much above the pre-war figure of 544. Returning troops from Mesopotamia, Egypt and the North-West Frontier account for this state of affairs.

Malaria, 145·6, venereal affections, 65·1, and respiratory diseases 56·8 per mille were the chief causes of the sickness. Plague caused 31 admissions and 20 deaths—0·09 per mille. Considerable improvement of the malaria figure is shown for Secunderabad, due to drainage operations.

A regrettable feature is the enormous increase of venereal disease—65·3 per mille. In 1913 it was as low as 12·6. This is attributed to the influence of the war.

Cholera was epidemic in the Punjab—134 admissions with 77 deaths (case-rate 0·5 and 0·34 per mille).

Health of the General Population.

Civil Population.—Owing to influenza the birth-rate fell from 37·85 to 30·24 per 1,000. Faulty registration, however, accounts for a certain amount of this fall. Death-rate 35·87: highest in Assam—50·09, lowest in Madras—27·2.

The general population suffered more from cholera, smallpox and diarrhoea than in previous years. Death-rates per mille being 12·43, 0·57 and 1·22. The Ganga Sagar mela in January was also a factor in the spread of cholera. In the Bombay Presidency the disease was worse than it has been for many years, probably during famine. Plague death-rate throughout the country was lower. Malaria death-rate fell from 46·6 in 1918 to 22·93 in 1919.

Jail Population.—The constantly sick and death-rates were 31 and 26·97 per mille.

ASSAM. Annual Public Health Report of the Province of Assam for the Year 1921. [YOUNG (T. C. McCombie), I.M.S.]—pp. ii + 34 + 3. 1922. Shillong: Assam Secretariat Press. [Price 12 annas or 1s. 6d.]

Total population 6,854,367.

Birth-rate 29·63, as compared with 31·53 in 1920.

Death-rate 26·48; previous quinquennium 36·17, but pre-influenzal rate 27·77.

Infant mortality, 187 per thousand children born.

Kala azar.—The activities against this disease have been considerable during the year. There are now 12 indoor dispensaries, with a total of 226 beds, for the reception of patients, five of which were opened during the year; seven existing hospitals have provided kala azar wards with a total of 144 beds. There are also 23 special out-patient dispensaries working 33 subsidiary sub-centres, whilst Government dispensaries and 43 local board dispensaries were furnished with the necessary appliances and drugs to enable them to treat kala azar patients.

At these various institutes 15,880 sick were treated. The figures show that the treatment is popular and that very good work is being done; in a few years there ought to be a considerable falling off in the amount of sickness from this disease in the province as a whole.

"An interesting light on this aspect of the work is shed by the progress of events in the North Cachar Hills, to deal with the outbreak in which we built a hospital at Moibong and extended that at Haflong. The hillman usually turns a kala-azar patient out of his village, burns the infected house and moves to a new site. The result of this eviction of patients was that all the cases sought admission to hospital, and that of removal from the infected site was that the cured patient returned to an uninfected house. The effect was that the outbreak for the time being appears to be almost extinguished in the North Cachar Hills, few patients are coming forward, and the opinion elicited in Moibong Bazar on 'hât' day, when people from all villages for many miles round assemble, was to the effect that there are no more cases and that those who were cured are living in new houses."

" Unfortunately the plainsman does not or cannot shift his house with the same facility, and we shall be longer in seeing the result of our work in an abatement of the disease in the plains, as we cannot yet attempt house removal on any large scale, but already the Assam Valley districts, except for Nowgong, in which kala-azar has always flourished exceedingly, are showing an abatement in the kala-azar mortality, perhaps most marked in Mangaldai, an area of kala-azar hyperendemicity in which the work has been particularly well administered."

UNITED PROVINCES. *Annual Report on the Condition and Management of the Jails in the United Provinces, with Tabular Statements, for the Year ending 31st December, 1921.* [WOOLLEY (J. M.), M.D., I.M.S.]—pp. ii + 20 + 99a + 4. 1922. Allahabad : Supt., Govt. Press. [Price Rs. 3.]

" This year's death-rate of 21·4 per mille compares unfavourably with that of the preceding year, which was 17·0, and the increase is chiefly confined to deaths from tubercle of lung, pneumonia, dysentery and cholera. There were also no less than 26 deaths from heat-stroke during the year, compared with eight only for the previous year. The year was remarkable for excessive heat and there was a severe epidemic of cholera in the province. The ratio per mille of deaths in the free population of these provinces was 39·56."

MEDEEDELINGEN VAN DEN BURGERLIJKEN GENEESKUNDIGEN DIENST IN NEDERLANDSCH-INDIË. 1920. Pt. 6. pp. 2-49. With tables, charts, and 2 maps. [In Dutch and German.] *Verslag van den Gezondheidsdienst van Batavia over het Jaar 1917. Jahresrapport des Gesundheitsdienstes der Stadt Batavia über das Jahr 1917.* [Report of the Sanitary Service of Batavia for the Year 1917.]

The first part of this report is not easy to summarize, as it consists largely of remarks on the results of the census of the various nationalities living in Batavia in the year under review, together with statistical tables illustrative of those statements.

Briefly, the native population, of which a census was taken in 1905, has nearly doubled during the succeeding 12 years, namely, from 99,320 in the former to 182,370 in 1917. Of these there were 4,835, or 2·6 per cent., under one year ; 5,381, or 29·4 per cent., between the ages of 1 and 15 years ; 110,311, or 60·5 per cent., between 16 and 50 years, and the remainder, 13,642, or 7·5 per cent., over 50. Of the total number, 49·3 per cent. were males, 50·7 per cent. females. The Chinese inhabitants numbered 37,581, of whom 57·5 per cent. were males and 42·5 per cent. females ; in 1905 the number was 28,150, showing an increase of 33 per cent. The Arab population was only 3,223, of which 51·9 per cent. were males and 48·1 per cent. females. The proportion of infants amongst the Arabs was higher than amongst the Chinese (3·1 per cent. as compared with 1·8 per cent.), and this is ascribed to polygamy in the former. In 1905 the Arab population was 2,058 ; there has, therefore, been an increase of 56 per cent.

Of the European population it is stated that reliable data could not be obtained in 1917, but during that year there were 599 legitimate births, and the writer arbitrarily estimates this as 3·5 per cent. of the population, thus arriving at a total of between 17,000 and 18,000. In 1905 the number was 8,777, so that the European population also has practically doubled.

In 1917 there were 309 deaths among Europeans, giving a mortality rate of 18 per thousand as compared with 28 in 1905. 15·8 per cent. of all causes of death were comprised by enteric fever, malaria, cholera and dysentery, but a reference to the tables appended to the report shows that tuberculosis of the lungs heads the list.

Amongst the Malay population the mortality in Batavia was 45·3 per thousand, as compared with Weltevreden's 37·9, and in this connexion the greater infection with ankylostomiasis is noted in the former. The worst month appears to be September, when the mortality rate for the Batavia district reaches 80 per thousand. Of the Malay population, out of 7,916 deaths 3,161, or 40 per cent., occurred amongst infants under 12 months of age. Of those dying in hospital, the diagnosis being confirmed, cholera is noted as the chief cause, with tuberculosis of the lungs second. Amongst the Chinese the mortality is higher than in the Malay population, namely, 53·1 (in one district as high as 57·3) per thousand. The quarters occupied by the former are dark and badly ventilated and their general surroundings are more insanitary. In one place it is recorded that the infantile mortality reached the enormous total of 523 per thousand. Finally, amongst the Arab population the death-rate ranges between 60·6 and 65·3 per thousand in different districts. Fifty-two per cent. of the total deaths occurred in children under one year, and nearly half (49·8 per cent.) of the children born died in the first 12 months. These figures are very striking when compared with the European infantile mortality, which is stated as 4 per thousand.

Generally, the chief causes of deaths of infants are convulsions, diseases of the respiratory organs, diarrhoeal conditions, malaria and undefined "debility at birth."

			Mortality per thousand.		
			Total.	Under one year.	Over one year.
Arab	District Batavia ..	..	65·3	32·0	33·3
	,, Weltevreden ..	..	60·7	33·3	27·3
Chinese	,, Batavia ..	..	57·3	22·3	35·0
	,, Weltevreden ..	..	45·4	19·9	24·5
Malay	,, Batavia ..	..	57·6	18·4	39·2
	,, Weltevreden ..	..	37·9	16·6	21·3

(Adapted from Table on page 25 of report.)

In comparing the districts of Batavia and Weltevreden, the author draws the following conclusions :—

- That the increased mortality which occurs in these races (Malay, Arab, Chinese) is not to be ascribed only to the infantile mortality, but that the risks are greater in Batavia for all age groups, mainly on account of malaria, which is much more rife in Batavia owing to the extensive breeding of mosquitoes in the fish-ponds of that district.

2. That this influence is perceptible throughout the year, but is particularly noticeable in the months of August and September.
3. That these months are those in which the incidence of malaria is greatest.
4. That the higher death-rate in Batavia in these months is mainly ascribable to malaria.

SPECIAL EPIDEMIC DISEASES.

Smallpox.—Only 28 cases occurred during the year; 18 of these ended fatally. Of the ten patients treated in hospital nine recovered. Seeing that only 22,240 vaccinations were carried out, and included in this number were 17,593 revaccinations, the number of cases is remarkably few and the mortality no higher than would be expected. The writer points out the difficulty of getting at the people in a large town such as Batavia unless district by district is systematically dealt with.

Cholera.—During the year under review there were 200 cases, a smaller number than in any of the preceding five years. There were 136 deaths, giving a case mortality of 68 per cent. The only year with which a reliable comparison can be made is 1916, in which there were 250 cases with a mortality of 81 per cent. Even in hospital, where patients received prompt and thorough treatment, there were 57 per cent. deaths.

It is worthy of note that among 21,000 persons inoculated in May of that year not a single case occurred, and only two up to the end of the year among 43,000 inoculated in the first week of December.

Diphtheria.—One death (a Chinese) only occurred out of 29 cases, and the remark is made that in Batavia the course of this disease is usually mild.

Plague.—No instances of the bubonic form are recorded, but there were two of the pneumonic. No plague infected rats were discovered, but the writer states that the examination of these is not very thorough.

Bacillary dysentery.—Forty-six cases were notified, with seven fatalities. Of these 46 more than half, namely, 24 (with two deaths), occurred amongst the European population; among the Malays there were 21 cases with four deaths; the remaining case was a Chinese. None were reported among the Arab population.

Typhoid fever.—Under this heading 388 cases were recorded, with 95 deaths, a mortality rate of 24·48 per cent. It is not stated whether any of these were instances of paratyphoid infection. Twenty-six of them were discovered post-mortem. Of 175 cases amongst Europeans there were 15 deaths (8·5 per cent.); amongst the Malays there were 114 cases, with 38 deaths (33·3 per cent.); while of 98 Chinese cases 42 died (42·8 per cent.). [The Table in the appendix referring to this disease contains several inaccuracies as regards the distribution and totals.]

Of other infective diseases tuberculosis receives special mention. Deaths from this disease constitute 6·1 per cent. of the total mortality among Europeans, but the writer is unable to state the actual prevalence of tuberculosis because, as has been already mentioned, there are no accurate data relative to the European population. Among the Malays he estimates the tuberculosis mortality at 24 per 10,000, whereas the

Chinese and Arabs show as high a rate as 43. This he attributes, in part at least, to the bad housing and general unhygienic conditions of life, to malnutrition, and debilitating diseases, such as malaria and ankylostomiasis.

Though these figures are high as compared with the Netherlands, they do not, he remarks, compare unfavourably with statistics from Vienna and Paris with 42 per 10,000 in the middle classes and 55 in the poorer; nor with Panama, where, he states, in 1916, out of a total mortality rate of 29 per thousand, the tuberculosis mortality was 51·5 per 10,000.*

SHANGHAI MUNICIPAL COUNCIL. Public Health Department. Report of Commissioner of Public Health, 1921. [DAVIS (C. Noel), Acting Commissioner of Public Health.]—47 pp. With 1 chart. 1922. Shanghai: Kelly and Walsh, Ltd., 30, Ferry Road. [Price not stated.]

Statistical Summary.

Situation : Latitude 31° 15' N.; Longitude 121° 29' E.

Elevation : Approximately sea-level.

Area within municipal limits : 5,584 acres, or 8½ sq. miles.

Density of population : 144 persons per acre.

Number of inhabited houses : { Foreign, 4,383.
Chinese, 62,396.

Population : { Foreign, 24,000.
Chinese, 780,000.

Death-rate : { Foreign, 18·2 per 1,000.
Chinese, 11·0 per 1,000.

Total rainfall : 58·3 in.

Anti-Rabic Treatment of Pasteur.—“ Since the opening of the Pasteur Institute in 1899, 897 persons have received the treatment. Among these there were nine deaths from hydrophobia and one from paralysis, a mortality of 1·11 per cent., eliminating those who failed to complete the treatment properly and those who developed hydrophobia within 15 days of the completion of the treatment, which cannot be charged to its failure, but to want of time to develop immunity.”

Twenty-six persons were bitten by rabid dogs within the Settlement during the year and were treated at the laboratory.

“ In addition, 101 persons bitten by dogs found not to be rabid came to the Health Office for advice. This very large number of dog bites shows how indifferent the public are to the proper muzzling of dogs. Dog owners often think that their own pets are harmless and fail to realize their responsibility to the public. In fact, Shanghai is not a suitable place for keeping dogs. The possession of dogs should be subject to the limitation that such possession must not interfere with the security, health and comfort of other people. There is always a reservoir of rabies infection on the borders of the Settlement from which Shanghai dogs may be infected.”

* Summarized by Dr. H. Harold Scott.

Ultimate Disposal of House Refuse.

								Year 1921.
Tons brought to shoots	..	..	..	..	..	..	..	159,813
Sold to farmers	..	..	..	..	..	..	..	35·3 per cent.
Used for filling and raising lowland	..	..	..	..	..	..	..	23·3 per cent.
Dumped at Depôt	..	..	..	..	..	..	..	41·4 per cent.
Total cost for year	..	..	..	..	..	..	..	\$25,700
Cost of disposal per ton	..	..	..	..	..	(Mex. cents)	..	13·3

" The noteworthy features in above table are :—

" 1. The large quantity of refuse disposed of to farmers for agriculture. This is the dominant satisfactory feature, as the return of all refuse to the soil is the ideal to be strived for.

" 2. The smaller quantity used for filling and raising.

" 3. The quantity dumped at Depôt is only 30 to 40 per cent. of the whole."

Ordure Removal.—" The removal of ordure continues to be done with a moderate degree of efficiency and is a source of considerable profit to the community. The amount paid monthly by the contractor in the sequence of agreements was, in 1899, \$3,200; 1902, \$4,100; 1905, \$5,300; 1908, \$6,000; 1910, \$7,500; 1913, \$10,050; 1916, \$14,800; 1919, \$15,050; 1920, \$16,200, and for 1921, \$15,760, with a deduction for emptying water-closet cesspools at the rate of \$1·50 per mensem per water-closet."

The above figures are of very great interest and importance. They show that China at any rate understands the importance of the utilization of excretal nitrogen to replenish that of the soil.

Analysis of Shanghai Waterworks Water.

Month.	Total Solids. Parts per 100,000.	Hardness.	Chlorine.	Nitrates.	Saline Ammonia.	Albuminoid Ammonia.	Oxygen absorbed in 1 hr. at 37° C.	Bacteria per cc.	Organisms of the coli-group present in cc.	
								Agar at 33° C.		
Jan.	13·0	8·5	1·8	0·0650	0·0012	0·0094	0·0556	120	20	2·0
Feb.	13·0	8·5	1·9	0·0570	0·0013	0·0096	0·0540	95	17	3·0
Mar.	14·4	8·7	1·9	0·0692	0·0012	0·0062	0·0384	400	42	0·2
April	16·6	9·0	2·4	0·0684	0·0010	0·0072	0·0336	42	22	15·0
May	14·6	8·8	2·1	0·0658	0·0011	0·0075	0·0300	296	352	0·2
June	16·6	9·0	2·7	0·0650	0·0012	0·0084	0·0330	84	4	3·0
July	13·6	8·5	1·8	0·0465	0·0016	0·0100	0·0422	192	80	7·0
Aug.	14·1	9·2	1·9	0·0515	0·0023	0·0102	0·0540	100	20	5·0
Sept.	11·2	7·8	1·4	0·0480	0·0020	0·0093	0·0496	224	52	50·0
Oct.	11·0	8·0	1·2	0·0428	0·0020	0·0099	0·0500	72	8	50·0
Nov.	12·4	8·4	1·0	0·0452	0·0020	0·0098	0·0520	222	22	25·0
Dec.	11·0	7·0	1·1	0·0570	0·0024	0·0088	0·0560	84	32	50·0

" Other waters examined have comprised both river and well waters, including a number of artesian wells. In two instances artesian well borings in Shanghai have struck, at a depth of about 300 ft., a water bearing stratum which yields a distinctly brackish water. A specimen received from Hangchow had similar brackish characters. This water was obtained from a depth of 195 ft. Other artesian wells have

yielded water of moderately good quality, though in all cases harder and not so generally suitable for domestic and manufacturing purposes as waterworks water."

LENNOX (Wm. G.). **A Comparative Study of the Health of Missionary Families in Japan and China and a Selected Group in America. A Statistical Study, supplemental to "The Health of Missionary Families in China."**—44 pp. With 21 figs. Denver, Colo., U.S.A., Dept. of Economics, University of Denver.

This paper is a supplement to the one published in Sanitation Supplement No. 2, 1921, p. 145. The following conclusions in the summary are of interest.

"This is a supplemental study of the health of 1,489 missionary families in Japan and China and 939 families in America. The study deals with 9,470 individuals, of which number 3,567 are adults and 5,903 children. Facts are tabulated concerning 868 foetal deaths, 741 deaths of children, and 11,388 cases of sickness. The principal facts are as follows."

"For the first six months, children in China have as good a chance for life as children in Japan or America. For the rest of childhood, however, they have not half the chance. In contrast with the other groups the second year of the child's life in China is the most dangerous."

"Contrary to the finding in China, the children in Japan born on the field do not show a higher death-rate than those born at home."

"The most frequent single cause of death in China is dysentery, in Japan malnutrition, each being responsible for a fifth of the deaths. Were it not for intestinal infections and smallpox mortality in China would not be higher than in Japan or America."

"Though the total incidence of sickness among adults is higher in Japan than in China, the more serious diseases—dysentery, malaria, sprue, typhus fever, and smallpox—are much more prevalent in China, no cases of the three last sicknesses being reported from Japan. Diarrhoea and round worm infection is slightly more common in Japan, where precautions of using boiled water, cooked vegetables, etc., are not observed. Nervous breakdown is nearly three times more frequent in Japan than in either China or America."

"Taking the groups studied as a whole, we may say that missionaries in Japan report an excessively high *foetal* death-rate, those in China an excessively high death-rate among young children. In China among both adults and children the excessive loss has been due to the intestinal infections and to smallpox, a loss which is a waste because largely preventable through application of well-known measures of sanitation and vaccination. In Japan, in distinct contrast though the death-rate of children is low, the percentage of deaths due to prenatal conditions, to disasters at birth and to difficulties in feeding is high. Among adults the chief difficulty has been in maintaining a sufficient nervous reserve. In a word, the menace in China is to life, in Japan to functional efficiency."

FEDERATED MALAY STATES. **Medical Report for the Year 1920.**
 DOWDEN (R.), acting P.M.O.; FLETCHER (W.), Bacteriologist;
 (Supplement to the *F.M.S. Government Gazette*. 1921. Nov. 4.)
 —34 pp.

Total population for 1920	..	..	..	1,351,541
Birth-rate	"	..	..	27·05 per mille.
Death-rate	"	..	..	32·34 "
Chief diseases death-rate :—				
Malaria	..	..	..	15·24 per mille.
Dysentery	..	..	..	2·81 "
Pulmonary tuberculosis	..	..	..	1·95 "
Beriberi	..	..	..	0·32 "

There appears to have been in the last 10 years a very decided improvement in the dysentery and diarrhoea figures and a marked reduction in beriberi in 1911. The death-rate from this disease in 1911 was 1·12 per mille; now it is 0·32.

Laboratory investigation in the dysenteries gave some interesting results.

“ The faeces of 88 cases contained blood and mucus or pus, and the results of examination, which were as follows, show that dysentery bacilli were found in 67 per cent. of the cases and amoebae in 21 per cent.

<i>Entamoeba histolytica</i>	..	..	..	..	17
” and <i>B. dysenteriae</i> Flexner	..	..	..	..	2
<i>B. dysenteriae</i> Flexner	..	..	..	..	55
” Shiga	..	..	..	..	2
No pathogenic organisms or protozoa found	..	..	..	..	12
Total					88

“ Fifty-three cases suffering from dysentery of the Flexner type agglutinated an emulsion of Flexner's bacillus as follows :—

Agglutination titre less than 1 in 100	..	..	..	5 cases.
” “ between 1 in 100 and 1 in 200	..	..	14	”
” “ higher than 1 in 200	..	..	34	”
Total				
	..	..	..	53 ”

Pseudo-cholera.—“ In previous annual reports reference has been made to the occurrence of groups of cases in which the onset of the disease resembled Asiatic cholera. The causative organism in certain of these cases has been identified and attention has been directed to the occurrence of natural infection in laboratory and domestic animals. Dr. Fletcher has shown that the causative organism is identical with that observed by him in 1914 as the cause of a very fatal epizootic among laboratory animals.

“ During the past year cultures of a micro-organism isolated by Major A. Whitmore, I.M.S., in the condition known as ‘ Rangoon Disease ’ have been compared with the micro-organism of pseudo-cholera in Malaya and their identity has been established. In Rangoon most cases of the disease have been identified only at post-mortem

examination. In Malaya there has been opportunity to study the earlier stages of the infection and also the immunity responses in cases ending in recovery.

" During the period under review one case of the disease in the human subject was observed—a Tamil estate cooly, inmate of the General Hospital, Kuala Lumpur. In this case the course of the disease resembled more closely the Rangoon disease than the more severe forms of the infection hitherto encountered in Malaya. The causative organism, *Bacillus pseudomallei*, was isolated from small subcutaneous abscesses. Tests of the patient's blood serum against his own organism, as well as against stock cultures from other sources, showed agglutination in dilutions from 1 : 2,500 to 1 : 3,000. Additional proof is thus brought that the micro-organism is related causally to the infection and that the diseases observed in Burmah and Malaya are different forms of the same infection.

" As has been noted in previous reports, epidemiological and experimental evidence points to the probability that the disease occurs as a natural infection in rodents and that it is communicated to man through food infection."

PENANG. Municipality of George Town. Health Officer's Annual Report for the Year 1921. [GLASS (G. S.), Acting Municipal Health Officer.]—pp. 26 + 7. 1922. Penang: The Criterion Press, Ltd. [Price not stated.]

This is an extremely interesting and valuable report. The following brief extracts are given.

Statistical Summary.—

Situation	Lat., 5° 24' N.; Long., 100° 1' E.
Average elevation above L.W.M.O.S.T. .. .	Town area, 12 ft. 6 in. Country area, 25 ft.
O.S. tides rise and fall .. .	9 ft.
Rainfall, 1921 (average of three readings within municipal limits)	130·9 in.
Mean temperature, 1921 ..	80·8° F.
Maximum	89·4° F.
Minimum	72·2° F.
Total area of Penang Island ..	108 sq. miles.
Area within municipal limits ..	9·4 sq. miles, or 5,803 acres.
Number of houses occupied ..	13,813
" unoccupied ..	1,376
Estimated population (mid-year)	123,300
Density of population .. .	13,117 per sq. mile; 21·2 per acre.
Crude death-rate .. .	30·61 per mille.
Birth-rate	30·56 "
The corrected death-rate was	26·87 per thousand.

Infant Mortality.—" The infant mortality was 165 per thousand births. The lowest rate previously recorded for the municipality was 205 in 1920, and the average for the preceding 10 years 251.

" A great many of our infant deaths might be prevented by cleanliness and skilful attention. . . .

" It is feared that most towns in the East might still take to heart the words written by Dr. Farr, the Registrar-General, in his 1864 report : ' the children of the idolatrous tribe who passed them through the fire to Moloch scarcely incurred more danger than is incurred by the children born in several districts of our large cities.'

Nationality.	Infant deaths per thousand births.				
	1921.	1920.			
European	62	Nil.			
Eurasian	84	186			
Chinese	168	211			
Malay	131	147			
Indian	229	267			
Others	218	100			
		<hr/>			
	165	205			
		<hr/>			

	Infant deaths per thousand births.				
	1921.	1920.			
Tetanus	22				
Intestinal diseases	38				
Respiratory diseases	31				
Prematurity and debility	32				
Convulsions	24				

" These causes accounted for 564 of the 631 infant deaths which occurred.

" We are still losing over 2 per cent. of our babies from tetanus—a striking testimony to the need for more trained midwives and more education for mothers.

" It is a great pity that all schoolgirls are not taught at least the rudiments of nursing and the right way to look after a baby. It is really heartrending to hear of the homicidal applications that are in daily use for the cord of new-born babies in Penang."

There were 3,768 births during the year, and the Municipal District nurses paid 15,762 visits ; in 1920 they recorded 5,576 visits.

Smallpox.—" The ' Syria ' case. This ship arrived late one evening and by an extraordinary privilege, contrary to all quarantine regulations, and granted exclusively to P. & O. vessels, was permitted to come alongside and discharge passengers without undergoing inspection by the Port Health Officer.

" The P. & O. privilege may have had some excuse as a wartime measure, but it might surely be revoked now.

" No community situated as we are can afford to be exposed to any unnecessary risk of having a smallpox epidemic, however slight that risk may appear.

" I see no reason why we in Penang should abandon in this matter the excellent safeguards provided in our quarantine regulations—regulations which are the result of the world-wide experience of centuries."

Tuberculosis.—" Phthisis again heads the list of causes of death. Almost one-fifth of the total deaths were attributed to phthisis and other forms of tuberculosis."

Malaria and Unspecified Fevers.—“ Our mosquito surveys led us to the belief that malaria was not likely to be acquired within municipal limits, and therefore that the death-rate from malaria was mostly, if not entirely, beyond our control.

“ The uncomfortable feeling remained that many of the deaths attributed on the meagre evidence available to malaria, by the Deputy Registrar of Deaths, might be due to some other cause, for example, to enteric fever.”

Domestic Water Supply.—“ The supervision of the catchment area has been transferred to the Water Engineer’s Department, on the ground of expediency ; it is most desirable that we should have, as soon as possible, our catchment area entirely cut off from all human dwellings, whether by contour drain or otherwise. . . .

“ The daily consumption per head in Penang is estimated at $45\frac{1}{2}$ gals. This is certainly not too much.”

Milk.—“ One sample had ‘at least 77 per cent. of added water,’ according to the Government Analyst.

“ The heaviest fine inflicted was 250 dollars.

“ Had the man who sold milk with 77 per cent. water been fined 250 dollars it would have taken him little more than three weeks to pay off the fine by his profits on the sale of water, if he averaged the same percentage.

“ Even without a milk vendors’ ring, then, the adulteration of milk seems profitable.

“ Unfortunately the 77 per cent. merchant was not fined at all ; he ran away to India instead.

“ As the law stands, no seller of adulterated milk need ever be fined if he is careful. I may mention one point alone.

“ When our agent finds milk which seems poor, he tests it roughly and, if necessary, proceeds to take samples in the official manner. The milkman probably knows the milk is below standard and may at once leave the town if he wishes. Or he may wait until we have the Analyst’s report and have applied for and received a summons.

“ From the date of service of the summons, he cannot be brought to Court within 14 days—a whole fortnight in which to arrange his affairs and make his departure.

“ That so many of them stand their trial and cheerfully pay their fines is a great tribute to the climate of Penang—or is it rather a proof of easy profits to be made here ? ”

JOHORE. Territorial Medical Report for the Year 1921. [ORME (W. B.), P.M.O.]—26 pp. 1922. Johore Bahru : Printed at the Government Printing Office. [Price not stated.]

Population of the State of Johore, 282,244, an increase on the census figures of 1911 of 56.4 per cent.

Birth-rate per mille : 1921, 36.02 ; 1920, 49.88.

The highest death-rate was classed among Indians, 54.46 per mille, while the Malay death-rate was only 27.27 per mille.

The infantile mortality for the year was 176.26 per mille, compared with 182.46 for the previous year.

The great fluctuation in the birth and death-rates within the last years is obviously due to the severe outbreak of influenza.

Throughout Johore there are two sets of hospitals, namely, the Government Hospitals and the Estate Hospitals. The comparison of the death-rates of certain diseases is extremely interesting.

For instance, under the head of hookworm the number of deaths to the number of cases is about 12 per cent.; in the Estate Hospitals, where a larger number of cases were treated, it is 2·4 per cent. The explanation of this is probably that only very advanced cases who are seriously ill go to Government Hospitals, whilst on the Estates labourers are sent to hospital for treatment by the local doctor much earlier in the case.

The same remarks apply to the malaria cases. The death-rate in Government Hospitals is 8·8, in the Estate Hospitals 3·3. The writer points out that the more severe cases are sometimes sent to Government Hospitals and the milder cases are ordered to go to the Estate Hospitals by the staff, and that many of the patients brought by the police arrive at the hospital practically moribund.

SEYCHELLES. Annual Report of the Medical Department for the Year 1921.

[ADDISON (J. B.), Chief Med. Officer.]—14 pp. 1922.
Victoria : Printed at the Government Printing Office.

Population.—The census of the colony was taken during the month of April and the total population was found to be 24,705. There were 3,066 children under five years in the Colony.

Birth-rate.—Seven hundred and nine births were registered during the year, being 28·57 per thousand of the population, a decrease on last year, when it was 29·81 per thousand.

Death-rate.—There were 392 deaths in the Colony during the year, being a mortality of 15·79 per thousand. Of these deaths 138 were in children under five years and of these 73 were under one. The high rate of mortality in young children was due to an epidemic of whooping cough.

CAPETOWN. The Corporation of the City of Capetown. Annual Report of the Medical Officer of Health for the Year ended 30th June, 1921.
[A. Jasper ANDERSON, M.O.H.]—pp. lxxiv. With 1 folding chart.
Cape Times Limited.

Comparative Table of Birth-rates for Various Centres.

District.	Period.	European.	Other than European.	All Classes.
England and Wales	1921	—	—	22·4
96 Great Towns in England and Wales, including London..	1921	—	—	23·5
148 Smaller Towns in England and Wales	1921	—	—	22·7
London ..	1921	—	—	22·8
Pretoria ..	1921	26·52	16·08	22·77
Johannesburg ..	1921	27·31	—	—
Kimberley (Urban)..	1920	37·20	Coloured. 41·50 Native. 14·80	27·10
Bloemfontein ..	1920	28·20	—	—
Pietermaritzburg ..	1921	27·38	—	—
Port Elizabeth ..	1920	30·40	47·22	36·27
East London ..	1921	26·00	52·00	37·00
Capetown ..	1920	26·17	51·88	37·89
..	1921	25·32	46·25	34·74

Comparative Table of Death-rates for Various Centres.

Place.	Period.	Euro-pean death-rate crude.	Corrected European death-rate for Visitors and age and sex distribution.	Non-Euro-pean death-rate crude.	Asiatic death-rate crude.	All Classes crude.
England and Wales ..	1921	—	—	—	—	12.1
96 Great Towns in England and Wales, including London ..	1921	—	—	—	—	12.3
148 Smaller Towns in England and Wales ..	1921	—	—	—	—	11.3
London ..	1921	—	—	—	—	12.4
Pretoria ..	1921	8.80	8.71†	16.12	19.31	—
Johannesburg	1921	—	11.07†	—	—	—
Kimberley (Urban) ..	1920	18.10	—	24.10	Natives 25.20	22.50
Bloemfontein	1920	17.2	9.2†	—	—	—
Pietermaritzburg ..	1921	12.25	9.94†	—	—	—
Port Elizabeth ..	1920	—	12.23†	—	—	—
East London	1921	—	10.5†	—	—	—
Cape Town ..	1920	12.92	11.08†	28.65	—	20.09
" ..	1921	13.68	12.03†	32.56	—	22.18

† Corrected for visitors only.

" The infant mortality for Europeans was 106.10. For the two preceding years it was 81.51 in 1920 and 114.69 in 1919. Exclusive of the infant deaths caused by the Spanish influenza epidemic, the 1919 rate becomes 102.85.

" With regard to the non-Europeans, the infant mortality was 238.52, as compared with 183.76 in 1920 and 297.80 in 1919. Exclusive of the infant deaths from Spanish influenza, the rate for 1919 becomes 231.52."

The enteric fever figures for so important a place as Cape Town show a very serious defect in the health administration. We would venture to suggest that it is time that a really systematic investigation was commenced into the prevalence of the disease. The only indication in the report as to its source is as follows :—" It appears from the above that the portions of the city not yet provided with sewers have the greatest prevalence." No remedial measures can be carried out until something more is known concerning the origin of the disease.

*Cases of Enteric Fever for the Year July 1, 1920, to June 30, 1921,
classified as to Race and Ward of the City to which they belong,
together with Balance of Cases.*

	Race.		All Classes.
	European.	Non-European.	
Wards of the City :			
1. Seapoint ..	31	3	34
2. Harbour ..	24	9	33
3. West Central ..	5	9	14
4. Kloof ..	17	19	36
5. Park ..	14	—	14
6. East Central ..	11	42	53
7. Castle ..	16	37	53
8. Woodstock ..	55	35	90
9. Salt River ..	60	34	94
10. Mowbray ..	34	24	58
11. Maitland ..	33	28	61
12. Rondebosch ..	15	32	47
13. Claremont ..	27	53	80
14. Kalkbay ..	11	1	12
Balance of Cases :			
Cases introduced from oversea ..	11	—	11
Cases contracted outside of City ..	36	14	50
Total Cases ..	400	340	740

We should like to know definitely whether the water supply is in any way incriminated.

Infant Mortality.—Under the head of work of female sanitary inspectors in connexion with infant welfare, tuberculosis, etc., it is recorded that 19,581 domiciliary visits were paid.

The number of children left at the crèche, July, 1920–June, 1921:—

Paying at 4d.

per diem.	Free.	Total.	Amount paid.
4,176	599	4,775	£69 12s. 0d.

Milk Supply, etc.—“The most serious danger to which the milk is subjected is the method of distribution. In one instance the milk was delivered in wide-mouthed glass bottles with cardboard discs, the bottles having been cleaned in cold water. In another case the milk was delivered in one-pint or two-pint tin cans previously sterilized by boiling water in them. The others mostly measured out the milk in the street by dippers.

“To a great extent the milk business is in the hands of people with small means, unable to obtain much capital, and occupiers only of the farm, and, as I know in some instances, can be turned out on short notice.

“Many of the apparent defects, such as dilapidated buildings, want of drainage, etc., ought in equity to be corrected by the owner of the premises, whilst under our laws and regulations we have to look to the occupier of the premises, whether he be the owner or not.”

The table giving the results of the inspection of meat condemned by the Inspector shows some very interesting facts. Whole carcasses, both in beef and pork, were most commonly condemned for measles. As regard what is generally termed as offal, the common causes of condemning were inflammatory conditions of the lungs in both sheep and pigs; liver fluke, tape worm, and cysts seem to be extremely common.

Catchpits and Prevention of Mosquitoes.—“With the object of preventing the development of mosquitoes, the catchpits in connexion with the stormwater sewers have been treated with disinfectants during the hot months of the year. An attempt is being made to render these catchpits ‘dry’ and so do away with the propagation of mosquitoes.”

We would draw attention to the particular design of street gully used in Colombo and designed by Mr. Cox, Engineer of that town, which keeps mosquitoes from breeding in these appliances (*vide* Sanitation Supplement No. 3, 1921, Oct. 30, p. 203).

CYPRUS. Annual Medical Report for the Year ending 31st December, 1921. [CORSELLIS (E. S.), Acting Chief Med. Officer.]—27 pp.
1922. Printed at the Government Printing Office, Nicosia.
[Price not stated.]

The estimated population at the end of the year 1921 was 313,515. For the year 1920 it was 315,219.

The total number of deaths was 6,213, the death-rate per 1,000 living being 19·8, as compared with 23·2 in 1920.

The total number of births registered during the year was 8,341, in 1920 it was 9,060. The birth-rate per 1,000 of population for 1921 was 26·6, in 1920 it was 28·7. The death-rate for infants under one year was 154·2 per 1,000; in 1920 it was 170·9.

Abstract of Spleen-rate Returns for October, November and December, 1921.

Total examined.	1	3	6	9	Spleen-rate.	Average spleen.
1920	37,953	35,073	2,481	313	86	7·5
1921	34,611	31,003	3,172	385	51	10·4

Note.—The enlargements of the spleen are classed under 1, 3, 6 and 9, because these numbers are likely to give roughly the comparative sizes of the organs with no enlargement, and small, medium and great enlargement, respectively.

“The Island has enjoyed complete immunity from plague, cholera and typhus, although the diseases prevailed in neighbouring countries. Quarantine of ships’ passengers, etc., had to be resorted to and a careful medical inspection at the port of arrival with disinfection of certain goods and effects was applied on all arrivals.”

GIBRALTAR. **City Council of Gibraltar.** **Annual Report on the Health of Gibraltar for the Year 1921.** [PARKINSON (G. S.), M.O.H.]—17 pp. With 3 charts. 1922. Gibraltar: Garrison Library Printing Establishment.

Summary of the vital statistics for 1921 :—

" Total area of Gibraltar Territory	1,387 acres 2 roods 3 poles
" Area of the City	104 acres 3 roods 33 poles.
" Estimated total civil population of Gibraltar	18,540 persons.
" Total births	429
" Birth-rate per 1,000 of fixed civil population	25·6
" Total deaths	292
" Crude death-rate per 1,000 of total civil population	16·83
" Average crude death-rate for previous 10 years	16·64.
" Standardized death-rate corrected for age and sex distribution..	18·52
" Death-rate from principal acute infectious diseases in total civil population	1·78 per 1,000.
" Death-rate from pulmonary tuberculosis	1·6 ..

" The marriage-rate was 8 per 1,000, compared with 9·6 per 1,000 in 1920.

" The birth-rate in 1921 was 25·6 per 1,000, this being 2·4 above that of 1920.

" The death-rate in 1921 was 16·83, being 0·62 below that of the preceding year.

" The infantile mortality was 102 per 1,000 births, being 26 per 1,000 below the rate of 1920. The mortality in infancy will be found examined in detail under that heading.

" Compared with 1920, the mortality for enteric fever and measles shows an increase, but that from diarrhoeal diseases a decrease.

" There was a decrease in the death-rate from influenza and phthisis, but in the case of pneumonia there was an increase."

JAMAICA. **Annual Report of the Central Board of Health for the Year ended 31st December, 1920.** [SOLOMON (M. C.), Secretary, Central Board of Health.]—40 pp. 1921. Government Printing Office, Kingston.

Hookworm Campaign.

Type of Sanitary Latrine Installed in Spanish Town, Parish of S. Catherine.—The pit type as recommended and approved by the Central Board of Health. This consists of an unlined pit, 6 ft. deep, with sloping sides to minimize caving in, over which a fly-proof box is fitted; this is set up on a hardwood sill, with well hinged fly-proof covers. A frame or wattle building, 5 ft. by 6 ft., is built over the pit, on hardwood sills well away from the edges of the pit, and roofed with palm thatch or zinc set at an incline of from 18 to 24 in. The building is well banked and trenched for drainage and can withstand removal to a new pit when necessary. Construction was undertaken by a contractor who had experience of similar work in Clarendon.

Return showing the Number of Cases of Typhoid Fever Reported month by month in each Parish during 1920 for the whole Colony.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Kingston ..	37	27	26	22	18	13	16	23	14	38	25	38	244
Other Parishes	64	15	13	36	54	32	47	48	60	79	92	78	671
Totals ..	101	42	39	58	72	45	63	71	74	117	117	116	915

Report on the Sanitary Condition of the City and Parish of Kingston for the year 1920.

Estimated population at December 31, 1920	..	..	58,758
Area of Parish—7 sq. miles	..	..	4,580
Births registered	..	..	2,218
Birth-rate per 1,000	..	..	37.74
Deaths registered	..	..	2,041
Death-rate per 1,000	..	..	34.73
Deaths of infants under one year	..	..	501
Infantile mortality-rate (per 1,000 registered births)	..	..	510
Tuberculosis (pulmonary) death-rate per 10,000	..	..	43.9
Enteric fever death-rate per 10,000	..	..	15.9
Malarial death-rate per 10,000	..	..	2.8
Pneumonia death-rate per 10,000	..	..	14.2
Intestinal affections per 10,000	..	..	52.2

Table of Deaths from Certain Causes.

Deaths.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Enteric Fever	8	6	10	7	4	12	7	8	2	8	9	13	94
Pulmonary tuberculosis	19	9	22	12	23	29	37	14	34	17	24	18	258
Intestinal affections	20	16	18	25	20	29	39	17	23	33	34	33	307
Malaria ..	1	1	2	2	2	2	1	1	1	3	1	—	17
Pneumonia ..	9	7	7	5	7	10	4	6	10	11	2	6	84
Totals ..	57	39	59	51	56	82	88	46	70	72	70	70	760

Enteric Fever Mortality.

"I have already expressed the opinion that the prevalence of enteric fever is largely due to the presence in large numbers of pits-closets, and an improvement in this respect may be expected to follow the comprehensive water-closeting of the city. There is no doubt that the retention of human excrement in these offensive pits is primitive and dangerous and should be abolished as soon as possible and replaced by sanitary conveniences more in keeping with the times.

"This is a matter of primary importance. It will cost money; but all competent authorities agree that money spent on sanitation is money wisely invested."

An investigation of the tables given above shows that enteric and intestinal affections are extremely common. Surely something can be done to investigate the cause of this state of affairs, which would appear to us to be infected water.

This report is not well arranged and is difficult to follow. The figures for the Colony as a whole are not prepared.

BRITISH GUIANA. Report of the Registrar-General for the Year 1920.
 [OZZARD (A. T.), Acting Registrar-General.]—15. + xlvi. pp.
 1922. Georgetown, Demerara: The "Argosy" Company,
 Limited, Printers to the Government of British Guiana. [Price
 not stated.]

Population: 307,290.

Birth-rate: 31.9 per thousand.

Death-rate: 25.6 per thousand.

Infant mortality: 148 per thousand children born.

The following were the principal causes of death of children under one year:—

Infantile debility, etc.	..	..	..	..	413
Bowel complaints (including dysentery, diarrhoea and enteritis)	..	..	..	..	247
Premature birth	..	..	..	..	234
Malaria	..	..	..	..	200
Pneumonia and bronchitis	..	..	..	..	133

UNITED FRUIT COMPANY (Medical Department). Tenth Annual Report. [DEEKS (W. E.), General Manager.]—110 pp. With 10 illustrations. 1921. [General Offices: Boston, Mass.]

It is extremely instructive to read annual reports of the medical departments of business concerns, because they demonstrate to the world at large what can be done by proper medical precautions.

The United Fruit Co., Boston, Massachusetts, is one of the largest and most enterprising business concerns operating in tropical countries; it has no less than nine separate divisions of activities, all within the tropical zone.

The total population dependent on the Company for medical treatment is close on 200,000; from this total should be deducted 31,000 who are only passengers on the Company's ships and about another 33,000 who are marked as non-employees and are presumably residents in villages in close proximity to the Company's hospitals.

Out of this very large total there were approximately 1,000 deaths per annum. It is hardly fair to work out the rate per thousand on the gross total (which would be about 5 per mille), because we are not quite sure whether the total of 200,000 really represents the population in which the deaths occurred.

A survey of the important tropical diseases, ankylostomiasis, malaria, typhoid, pneumonia, etc., shows that there is no serious prevalence of any of these. Malaria naturally gives the highest figure, about 36,000 admissions to hospital in the year, ankylostomiasis about 2,400, and pneumonia about 1,000.

We give some pictures illustrating the antimalarial work that has been carried out in the neighbourhood of some of the Company's villages, and also of a fine new hospital recently constructed at Limon, Costa Rica. This shows better than a lengthy description the extent of the medical activities of the Company.

In the report is an interesting appendix, occupying about 10 pages of printed matter, of general recommendations concerning sanitation and prevention of disease in the tropics. This appendix would form a very suitable pamphlet to be put in the hands of non-medical people proceeding to any hot country.

UNITED FRUIT COMPANY.



FIG. 108.—Puerto Castilla : Labourers' Quarters before filling.



FIG. 109.—Puerto Castilla : Labourers' Quarters after filling.

[Reproduced by permission from the *Tenth Annual Report of the Medical Department of the United Fruit Company.*]

UNITED FRUIT COMPANY.



FIG. 110.—Puerto Castilla : Labourers' Camps before filling.



FIG. 111.—Puerto Castilla : Labourers' Camps after filling.

[Reproduced by permission from the *Tenth Annual Report of the Medical Department of the United Fruit Company.*]



FIG. 112.—New Hospital of the United Fruit Company at Limon, Costa Rica.

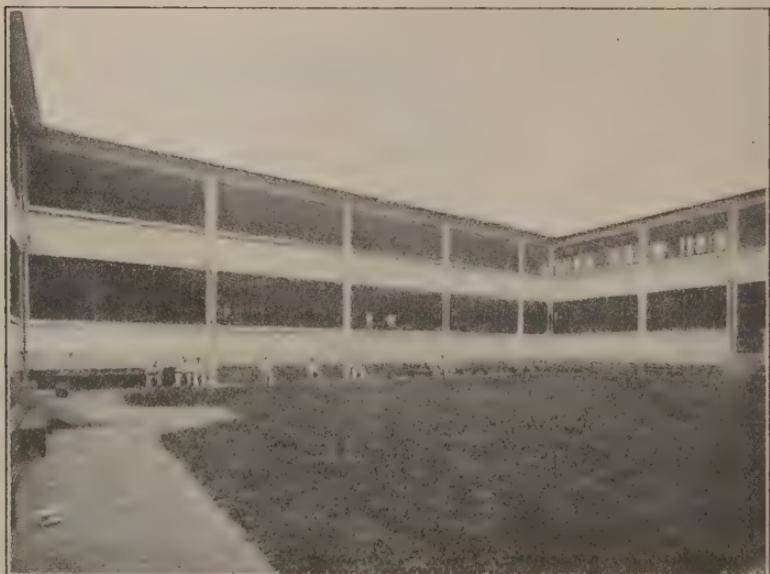


FIG. 113.—Patio of New Limon Hospital.

[Reproduced by permission from the *Tenth Annual Report of the Medical Department of the United Fruit Company*.]

MISCELLANEOUS.

SAVAGE (William G.). **The Methods used for the Inspection of Canned Foods. Part II. Canned Marine Products.**—*Dept. of Scientific & Industrial Research Investigation Board. Special Report. No. 10.*—32 pp. 1922. London : H.M. Stationery Office. [Price 1s. 6d. net.]

The above is the second portion of the report already reviewed by us in the Sanitation Supplement, Mar. 30, 1922, pp. 84-5.

The second portion deals entirely with tinned "fish." The word "fish" includes, of course, such crustacea as crabs, lobsters, shrimps, etc. The paper is an extremely useful one and should be in the hands of all medical officers and staff who have anything whatever to do with the inspection of tinned provisions.

The author divides the classification of doubtful tins into the same groups as in the previous report.

(a) Those rejected by trade examiners, but passed by Food Inspectors.

(b) Rejected as doubtful and unsafe to pass.

(c) Rejected as definitely unfit.

By way of control a large number of tins that had passed all inspection were purchased from shops in order to ascertain whether these undoubtedly sound tins were free from bacteria. The results are given in the accompanying table and show that quite a large percentage of this type of goods is not necessarily sterile, though they are perfectly fit for human consumption.

Marine Product.	No. of Samples Examined.	Sterile.	Non-sterile.	Percentage Sterile.
Salmon.. .	16	8	8	50
Sardines ..	11	7	4	64
Herrings ..	8	3	5	38
Crab .. .	6	0	6	0
Lobster .. .	6	1	5	17
Crayfish .. .	3	2	1	67
	50	21	29	42

The type of bacteria usually found in them is *subtilis* and some spore-bearing organisms.

The author then carefully investigated bacterially the doubtful and condemned tins ; the results are given in tables.

"The figures show that the tins which are unmistakably 'blown' are nearly always unfit or contain decomposing bacteria. Of the 57 tins which were definitely 'blown,' all of them contained gas, and in the majority the contents were obtrusively unsound. They would all have to be condemned, and no difficulty arises as regards tins showing definite signs of internal pressure.

"The other tins were rejected almost entirely on account of an abnormal shake sound, and springy conditions of the tins, or a combination of both characters. There is no uniformity of procedure,

although as a rule such tins are rejected. In Group A are included tins in every way similar as regards their physical characters to those included in Group B and part of Group C, but in the one group they are passed, whilst in the others they are rejected.

" It is evident that the interpretation of tins with these characters offers the chief difficulty. When the Inspectors have rejected such tins they have sometimes been right, but in not more than about 40 per cent. of the cases. The figures for the different products for these tins were as follows :—

Marine Product.	Number of Samples Examined.	Food Inspector's decision correct judged by all available data.	Percentage Correct.
Salmon	25	9 + 2 doubtful	36 (44)
Sardines	16	4 + 3 doubtful	25 (44)
Herrings	9	3	33
Crab	8	3	37·5
Lobster	6	3	50
Crayfish	5	2	40

" The five tins included as doubtful contained sporing aerobic bacilli, but otherwise were perfectly good, and in view of findings with perfectly good shop samples, it is thought reasonable that they should have been passed.

" It is a point of practical interest whether this very considerable error is peculiar to any one kind of defect, *i.e.*, springy tin, abnormal shake sound, etc., or whether a combination of both defects yields a higher percentage of unfit samples. The tables already given provide the data, but the results are more easily apprehended in the following table :—

Physical Defects of Tins.	Number of Tins Examined.	Judgment.		Judgment.	
		Right.	Wrong.	Per-cent Right.	Per-cent Wrong.
Springy only	44	24	20	54·5	45·5
Shake sound only abnormality	14	4	10	29	71
Springy tin and abnormal shake sound	25	14	11	56	44
All defects together ...	83	42	41	50·6	49·4

"The table shows that judgment was correct for rather over half the springy tins, and that it made little or no difference whether or not an abnormal shake sound was also present. In only one-third of the samples rejected on account of an abnormal shake sound was the judgment correct. A study of the results of examination goes to show that the errors of interpretation occurred with every kind of marine product and were not confined to any one class."

EGYPT (Ministry of the Interior). **Department of Public Health.**

Model Conditions drawn up by the Department of Public Health for Certain Manufactories, Shops, Markets, etc., requiring Licences under the "Etablissements insalubres" Law. Second Edition.—224 pp. (Also in Arabic.) 1920. Cairo : Government Press. [Price not stated.]

This volume contains the departmental orders and what may be called model by-laws regulating such important establishments as food markets, bakeries, shops for the sale of milk and dairy produce, ice-cream factories, aerated water factories, dye works, public cattle markets, cattle sheds, pigsties, etc.

The sections are given both in English and in Arabic. It is unnecessary for us to give details of these by-laws, but we strongly recommend all officers in administrative charge of sanitary departments within the Empire to obtain copies of the work, as they will be useful in modelling local enactments in other countries.

We do not say that modifications would not be necessary in many parts of the world, but the rulings made use of in Egypt seem to be eminently satisfactory for that country, and, indeed, for many others in the East.

REVIEWS AND NOTICES.

BUNKER (George C.) & SCHUBER (Henry). **The Reactions of Culture Media.**—Reprinted from *Jl. Amer. Water Works Assoc.* 1922. Jan. Vol. 9. No. 1. pp. 63–116. With 7 text figs.

Much attention has of late been devoted to the reaction of bacteriological culture media and to methods for obtaining definite ranges of acidity and alkalinity by means of determinations of hydrogen-ion concentration, upon which "reaction" actually depends. The determination of hydrogen-ion concentration was formerly carried out by measurements of electrical potential by delicate physical methods, but during the last few years a series of new and distinctive colour indicators has been introduced, the reactivities of which in terms of hydrogen-ion concentration have been measured and the values of which are, therefore, known. With these, determinations of hydrogen-ion concentration are carried out by comparison with colour-standards prepared with them. The principal of these indicators are thymol blue, brom-phenol blue, brom-cresol purple, brom-thymol blue, phenol red and cresol red.

"Ions" are the atoms, or groups of atoms, bearing an electric charge, into which every acid, base and salt in solution is believed partially to break up. Thus water (H_2O) is believed to exist in the state of H_2O , H and OH, caustic soda as NaOH, Na and OH, and so on; the H, Na and OH are electrically charged and are the "ions." Hydrogen and metallic ions bear a positive charge, OH and acid radicals a negative charge. An excess of positive ions constitutes *acidity*, a deficiency of positive ions (with an excess of negative ions) constitutes *alkalinity*. In descriptions of reaction on this basis it has become customary to take into account only the relative number of hydrogen or other positive ions present, hence the name "hydrogen-ion concentration" (designated by the symbol H_p , pH or P_h) given to this method.

A single consideration will indicate that this must be a more accurate method for describing reaction than one based on capacity for neutralizing an acid or an alkaline solution. A solution which is just decidedly alkaline to litmus is decidedly acid to phenolphthalein; this solution would, therefore, be described as being "alkaline" were litmus used as the indicator, but as being "acid" were phenolphthalein used, and it obviously cannot be both! Hydrogen-ion concentration also explains why one acid (or alkali) is "stronger" than another; thus sulphuric acid will "turn out" oxalic acid, and caustic potash ammonia, from their combinations. In equi-molecular solutions there are more hydrogen-ions in the "stronger" acid than in the "weaker" acid.

Hydrogen-ion concentration, P_h , is designated by a figure which is the logarithm without the minus sign of the fraction of the weight of the substance which is believed to break up into the positively-charged atoms. Thus for pure distilled water, 0.0000001 part of the water is believed to break up into hydrogen-ions and the logarithm of this figure is -7. Dropping the minus sign, the figure 7 represents the hydrogen-ion concentration of pure water and is taken as neutrality—neutrality = P_h 7.0. Owing to the dropping of the minus sign, the *smaller* the figure representing P_h , the *larger* the hydrogen-ion concentration, for $\log. 0.1 = -1$, $\log. 0.01 = -2$, and so on. Figures of hydrogen-ion concentration smaller than 7.0 indicate, therefore, acidity, and figures larger than 7.0 indicate alkalinity.

In the paper under review, the authors give the results of their experience in determining the hydrogen-ion concentration of some of the commonly used bacteriological culture media by means of colour standards. These

colour standards are prepared according to SÖRENSEN's directions by mixing various proportions of $\frac{1}{15}$ molecular solutions of acid potassium phosphate and alkaline sodium phosphate, and adding to the mixture five drops of an aqueous 0·01 per cent. solution of phenol red.* The mixtures are then put up in sealed tubes, and the medium with indicator is compared with them and adjusted by the addition of acid or alkali to the required tint and so to the particular hydrogen-ion concentration required. Another method is to use the series of indicators referred to above, each of which gives a distinctive reaction over a small range of hydrogen-ion concentration. Thus brom-cresol purple reacts between $P_h = 5\cdot4$ and $6\cdot6$, brom-thymol blue between $P_h = 6\cdot4$ and $7\cdot6$, and phenol red between $P_h = 7\cdot0$ and $8\cdot2$, and these three cover the range of reaction for ordinary culture media. The authors summarize the methods by which they adjust the reactions of the culture media and the manner in which comparisons are made with the colour standards. They also give the formulae of several of the culture media employed. Media were obtained from various laboratories and their hydrogen-ion concentration was determined; for nutrient agar P_h varied between $6\cdot4$ and $7\cdot6$.

In conclusion, it is suggested that for nutrient agar and gelatin, lactose agar, and nutrient and sugar broths, the reaction should be adjusted to $P_h 6\cdot8$ to $7\cdot2$ by means of colour standards prepared according to MEDALIA's directions.

R. T. Hewlett.

BLACKHAM (R. J.) [C.B., C.M.G., C.I.E., D.S.O., M.D., F.R.F.P.S., M.R.C.P.E., D.P.H.(Lond.)]. **Aids to Tropical Hygiene.** With a preface by Lt.-Gen. Sir John GOODWIN [K.C.B., C.M.G., D.S.O., K.H.S., F.R.C.S.]. 2nd Edition, enlarged, thoroughly revised, and mostly re-written. 240 pp. With 1 text fig. 1922. London: Baillière, Tindall, & Cox, 8, Henrietta Street, Covent Garden. [Price, 4s. 6d. net.]

The aims of this little book are excellent; it is to provide the student reading for his D.T.M. and H. examination, or the Major, R.A.M.C., with a ready means of revising his reading and at the same time to furnish the junior practitioner with a handy pocket-book summarizing the main facts relating to public health in the tropics.

In the preface we are given to understand that it has a wide circulation in the New World.

Through the book one misses the "personal touch" and a certain lack of discrimination in the selection of material. Quite considerable portions of the subject matter, especially the section devoted to the climate of the tropics, has been culled from text books, such as CASTELLANI and CHALMERS, which is described in the terminal list of references as a "mine of information," though much of this section is merely conjectural and can hardly be considered as of primary importance to the medical officer of health.

The provision of some simple figures or diagrams would do much to enhance the teaching value of this book, and especially is this the case where various types of incinerator are being discussed, or in the section devoted to medical zoology. Some of the facts stated may be considered positively misleading, and this is especially the case in the consideration of diseases disseminated by flies. It is not clear from what source the information is obtained that tubercle bacilli multiply more rapidly in the intestines of flies than they do in cultures, nor is it correct in a work of this description, where only well ascertained facts should be considered, to charge the bed-bug with conveyance of anthrax, kala azar, leprosy, some skin diseases, tuberculosis, and yaws; to state definitely that *Ornithodoros moubata* carries *Filaria persans*, and to assume that *Argas americanus* conveys relapsing fever in Colombia.

* See L. S. MEDALIA, *Jl. of Bact.*, 1920, Vol. 5, p. 441.

The etiology of a few diseases, such as malaria, amoebic dysentery, leishmaniasis, trypanosomiasis and the spirochaetal diseases are set forth in some detail, while plague, cholera, bacillary dysentery and typhus are not considered in this respect. In malaria the romantic history which led up to its final elucidation is treated at some length, but we must note with regret that the name of Patrick MANSON has somehow been omitted.

With more exact editing and with better discrimination in the selection of material and in the compilation of tables of exact information, this book could be made to fulfil a wider purpose and to appeal to the sincere student, but it can hardly do so when vital problems of disinfection and sanitation are handled in such a brief and sketchy manner.

Philip Manson-Bahr.
